International Code Council

ICC 500-2020 edition

Public Input Agenda with Committee Votes and Public Comments based on input received on 2014 edition of the ICC 500 Standard

For February, 2020

2nd Meeting – Teleconference

Matrix for ICC 500 proposals with Committee Votes or Public Comments

Matrix for ICC 500 proposals

Proposal #	Result	Final Results	Affirmative	Affirmative with	Negative with	Abstain with	Public Commen	Meeting Date	Notes
Chapter 1 APPLICATION AND ADMINISTRATION									
IS-STM 01-01-18	AM AFM		11	4	0	0	1		
IS-STM 01-02-18	AM		14	1	0	0	0		
IS-STM 01-03-18	D	D	15	0	0	0	0		
IS-STM 01-04-18	D	D	15	0	0	0	0		
IS-STM 01-05-18	D	D	15	0	0	0	0		
IS-STM 01-06-18	D	D	15	0	0	0	0		
IS-STM 01-07-18	D	D	15	0	0	0	0		
IS-STM 01-08-18	D	D	15	0	0	0	0		
IS-STM 01-09-18	D	D	15	0	0	0	0		
IS-STM 01-10-18	D	D	15	0	0	0	0		
IS-STM 01-11-18	AS		14	1	0	0	0		
IS-STM 01-12-18	AM		14	1	0	0	0		
IS-STM 01-13-18	AM		12	2	1	0	1		
IS-STM 01-14-18	AM		13	2	0	0	0		
IS-STM 01-15-18	AM		12	2	1	0	0		
IS-STM 01-16-18	AS		11	4	0	0	1		
IS-STM 01-17-18	AS	AS	15	0	0	0	0		
IS-STM 01-18-18	AS	AS	15	0	0	0	0		
IS-STM 01-19-18	AM	AM	15	0	0	0	0		
IS-STM 01-20-18	AS		14	1	0	0	1		
IS-STM 01-21-18	AM		14	1	0	0	1		
IS-STM 01-22-18	AM		15	0	0	0	1		
IS-STM 01-23-18	D	D	15	0	0	0	0		
IS-STM 01-24-18	D	D	15	0	0	0	0		
IS-STM 01-25-18	AM		13	2	0	0	0		
IS-STM 01-26-18	W	W							
IS-STM 01-27-18	AS		13	2	0	0	0		
IS-STM 01-28-18	AM		11	3	1	0	2		
IS-STM 01-29-18	AS	AS	15	0	0	0	0		
Total				26	3	0	8		
Chapter 2 DEFINITIONS									
IS-STM 02-01-18	AM		14	1	0	0	0		Assigned to work group 1
IS-STM 02-02-18	AS	AS	15	0	0	0	0		
IS-STM 02-03-18	D	D	15	0	0	0	0		
IS-STM 02-04-18	AS	AS	15	0	0	0	0		

Proposal #	Result	Final Results	Affirmative	Affirmative with	Negative with	Abstain with	Public Commen	Meeting Date	Notes
IS-STM 02-05-18	D	D	15	0	0	0	0		
IS-STM 02-06-18	D	D	15	0	0	0	0		
IS-STM 02-07-18	D	D	15	0	0	0	0		
IS-STM 02-08-18	AM		15	0	0	0	1		Assigned to work group 3
IS-STM 02-09-18	AM		13	1	1	0	0		Assigned to work group 8
IS-STM 02-10-18	AM		13	1	1	0	1		Assigned to work group 3
Total				3	2	0	2		
Chapter 3 STRUCTURAL DESIGN CRITERIA									
IS-STM 03-01-18	AM	AM	15	0	0	0	0		
IS-STM 03-02-18	AM		15	0	0	0	1		
IS-STM 03-03-18	W	W							
IS-STM 03-04-18	AM AFM		13	2	0	0	0		
IS-STM 03-05-18	D	D	15	0	0	0	0		
IS-STM 03-06-18	D	D	15	0	0	0	0		
IS-STM 03-07-18	W	W							
IS-STM 03-08-18	AM	AM	15	0	0	0	0		
IS-STM 03-09-18	AM		13	2	0	0	0		
IS-STM 03-10-18	AM		13	2	0	0	0		
IS-STM 03-11-18	AM		14	0	1	0	0		
IS-STM 03-12-18	AM		12	3	0	0	2		
IS-STM 03-13-18	D	D	15	0	0	0	0		
IS-STM 03-14-18	AM		14	1	0	0	0		
IS-STM 03-15-18	AS		15	0	0	0	1		
IS-STM 03-16-18	AM	AM	15	0	0	0	0		
IS-STM 03-17-18	AM	AM	15	0	0	0	0		
IS-STM 03-18-18	W	W							
IS-STM 03-19-18	AM		13	1	1	0	1		
IS-STM 03-20-18	AM	AM	15	0	0	0	0		
IS-STM 03-21-18	AM	AN	15	0	0	0	0		
IS-STM 03-22-18	AM		13	2	0	0	0		
IS-STM 03-23-18	AM		15	0	0	0	1		
IS-STM 03-24-18	AS		14	1	0	0	0		
IS-STM 03-25-18	AS	AS	15	0	0	0	0		
IS-STM 03-26-18	D	D	15	0	0	0	0		
IS-STM 03-27-18	AM		11	4	0	0	0		

Proposal #	Result	Final Results	Affirmative	Affirmative with	Negative with	Abstain with	Public Commen	Meeting Date	Notes
IS-STM 03-28-18	AS	AS	15	0	0	0	0		
IS-STM 03-29-18	AS	AS	15	0	0	0	0		
IS-STM 03-30-18	AS		14	1	0	0	1		
Total				19	2	0	7		
Chapter 4 SITING									
IS-STM 04-01-18	D	D	15	0	0	0	0		
IS-STM 04-02-18	D	D	15	0	0	0	0		
IS-STM 04-03-18	D	D	15	0	0	0	0		
IS-STM 04-04-18	D	D	15	0	0	0	0		
IS-STM 04-05-18	AS	AS	15	0	0	0	0		
IS-STM 04-06-18	D	D	15	0	0	0	0		
IS-STM 04-07-18	D	D	15	0	0	0	0		
IS-STM 04-08-18	AS		14	1	0	0	0		
IS-STM 04-09-18	AS		13	2	0	0	0		
IS-STM 04-10-18	AS		11	1	3	0	2		
IS-STM 04-11-18	AS	AS	15	0	0	0	0		
IS-STM 04-12-18	AS	AS	15	0	0	0	0		
IS-STM 04-13-18	AS	AS	15	0	0	0	0		
IS-STM 04-14-18	AS	AS	15	0	0	0	0		
Total				4	3	0	2		
Chapter 5 OCCUPANCY, MEANS OF EGRESS, ACCESS AND ACCESSIBILITY									
IS-STM 05-01-18	AM	AM	15	0	0	0	0		
IS-STM 05-02-18	D	D	15	0	0	0	0		
IS-STM 05-03-18	AM		14	1	0	0	1		
IS-STM 05-04-18	D	D	15	0	0	0	0		
IS-STM 05-05-18	AM		15	0	0	0	1		
IS-STM 05-06-18	AM		14	1	0	0	0		
IS-STM 05-07-18	D	D	15	0	0	0	0		
IS-STM 05-08-18	AS	AS	15	0	0	0	0		
IS-STM 05-09-18	AM		14	1	0	0	1		
IS-STM 05-10-18	D	D	15	0	0	0	0		
IS-STM 05-11-18	D	D	15	0	0	0	0		
IS-STM 05-12-18	D	D	15	0	0	0	0		
IS-STM 05-13-18	D	AFM	15	0	0	0	0		

Proposal #	Result	Final Results	Affirmative	Affirmative with	Negative with	Abstain with	Public Commen	Meeting Date	Notes
	AFM								
IS-STM 05-14-18	AM AFM	AFM	15	0	0	0	0		
IS-STM 05-15-18	AM	AM	15	0	0	0	0		
IS-STM 05-16-18	D	D	15	0	0	0	0		
IS-STM 05-17-18	AM	AM	15	0	0	0	0		
IS-STM 05-18-18	AM		13	2	0	0	1		
IS-STM 05-19-18	AS		11	4	0	0	2		
Total				9	0	0	6		
Chapter 6 FIRE SAFETY									
IS-STM 06-01-18	D	D	15	0	0	0	0		
IS-STM 06-02-18	D	D	15	0	0	0	0		
IS-STM 06-03-18	D	D	15	0	0	0	0		
IS-STM 06-04-18	AM		12	1	2	0	3		
IS-STM 06-05-18	D	D	15	0	0	0	0		
IS-STM 06-06-18	D	D	15	0	0	0	0		
IS-STM 06-07-18	AS	AS	15	0	0	0	0		
Total				1	2	0	3		
Chapter 7 SHELTER ESSENTIAL FEATURES AND ACCESSORIES									
IS-STM 07-01-18	AM	AM	15	0	0	0	0		
IS-STM 07-02-18	AM D	D	15	0	0	0	0		
IS-STM 07-03-18	AM		13	2	0	0	0		
IS-STM 07-04-18	AM	AM	15	0	0	0	0		
IS-STM 07-05-18	AM	AM	15	0	0	0	0		
IS-STM 07-06-18	AM	AM	15	0	0	0	0		
IS-STM 07-07-18	D	D	15	0	0	0	0		
IS-STM 07-08-18	AS		14	1	0	0	1		
IS-STM 07-09-18	AM		14	1	0	0	0		
IS-STM 07-10-18	AS	AS	15	0	0	0	0		
IS-STM 07-11-18	D		14	1	0	0	1		
IS-STM 07-12-18	AM		14	1	0	0	0		
IS-STM 07-13-18	AM		14	1	0	0	1		
IS-STM 07-14-18	AM	AM	15	0	0	0	0		
IS-STM 07-15-18	D	D	15	0	0	0	0		

Proposal #	Result	Final Results	Affirmative	Affirmative with	Negative with	Abstain with	Public Commen	Meeting Date	Notes
IS-STM 07-16-18	AS	AS	15	0	0	0	0		
IS-STM 07-17-18	AM AFM	AFM	15	0	0	0	0		
IS-STM 07-18-18	AS	AS	15	0	0	0	0		
IS-STM 07-19-18	AS	AS	15	0	0	0	0		
Total				7	0	0	3		
Chapter 8 TEST METHODS FOR IMPACT AND PRESSURE TESTING									
IS-STM 08-01-18	AM	AM	15	0	0	0	0		
IS-STM 08-02-18	AS	AS	15	0	0	0	0		
IS-STM 08-03-18	AS	AS	15	0	0	0	0		
IS-STM 08-04-18	AM	AM	15	0	0	0	0		
IS-STM 08-05-18	D	D	15	0	0	0	0		
IS-STM 08-06-18	AS	AS	15	0	0	0	0		
IS-STM 08-07-18	AM	AM	15	0	0	0	0		
IS-STM 08-08-18	AM	AM	15	0	0	0	0		
IS-STM 08-09-18	AM	AM	15	0	0	0	0		
IS-STM 08-10-18	AM		14	1	0	0	0		
IS-STM 08-11-18	AM	AM	15	0	0	0	0		
IS-STM 08-12-18	AM	AM	15	0	0	0	0		
IS-STM 08-13-18	AM	AM	15	0	0	0	0		
IS-STM 08-14-18	AM		15	0	0	0	1		
IS-STM 08-15-18	AS	AS	15	0	0	0	0		
IS-STM 08-16-18	AS		15	0	0	0	1		
IS-STM 08-17-18	AS		14	1	0	0	1		
IS-STM 08-18-18	AS		13	2	0	0	0		
IS-STM 08-19-18	AM		14	1	0	0	2		
IS-STM 08-20-18	AS	AS	15	0	0	0	0		
IS-STM 08-21-18	AM		15	0	0	0	1		
IS-STM 08-22-18	AM		15	0	0	0	2		
IS-STM 08-23-18	AS		14	1	0	0	0		
IS-STM 08-24-18	AS	AS	15	0	0	0	0		
Total				6	0	0	8		
Chapter 9 REFERENCED STANDARDS									
IS-STM 09-01-18	AM		13	2	0	0	0		Assigned to work group 1

Proposal #	Result	Final Results	Affirmative	Affirmative with	Negative with	Abstain with	Public Commen	Meeting Date	Notes
IS-STM 09-02-18	AS	AS	15	0	0	0	0		
IS-STM 09-03-18	AS	AS	15	0	0	0	0		
Total				2	0	0	0		
Multi-chapter proposals									
IS-STM 10-01-18	AM	AM	15	0	0	0	0		
IS-STM 10-02-18	D	D	15	0	0	0	0		
IS-STM 10-03-18	AM	AM	15	0	0	0	0		
IS-STM 10-04-18	AS	AS	15	0	0	0	0		
IS-STM 10-05-18	AM	AM	15	0	0	0	0		
IS-STM 10-06-18	AM	AM	15	0	0	0	0		
IS-STM 10-07-18	AM		15	0	0	0	1		Assigned to work group 1
IS-STM 10-08-18	AS	AS	15	0	0	0	0		
IS-STM 10-09-18	AS	AS	15	0	0	0	0		
Total				0	0	0	1		

This document includes all proposal that received a committee vote for other than affirmative without comment or if they received a public comment. The order of the information is Original change and reason; committee action, including any modifications and reason; vote and PC report and votes and public comments, including reason and proposed further modification.

FOR PROPOSALS THAT RECIVED UNANIMOUS CONSENT AND NO PUBLIC COMMENTS, SEE THE "ICC 500 PUBLIC INPUT AGENDA WITH REPORT OF COMMITTEE ACTION."

Revisions to the text are in legislative format – strikeout of what is to be removed, and underlined for new. Revised text in the proposals in red is to highlight the changes in a proposal where it was difficult to find the revision quickly.

Staff notes located in this document provided to indicate proposals that may require coordination; technical information; or terminology that is not good code language (e.g. "may" or "guarantee", the use of "when" where the use is not a function of time). Staff notes are provided to assist the committee or proponent for possible modification. It is not intended to provide an opinion.

Chapter 1
APPLICATION AND ADMINISTRATION

IS-STM 01-01-18
ICC 500 Section 101.2

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

101.2 Scope. This standard applies to the design, construction, installation and inspection of storm shelters constructed for the purpose of providing protection from the effects of high winds during ~~associated with~~ tornadoes and hurricanes. Storm shelters may be either constructed as separate~~,~~ detached buildings or constructed as rooms or spaces ~~and areas~~ within buildings. Shelters designed and constructed to this standard shall be designated as hurricane shelters, tornado shelters or combined hurricane and tornado shelters. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard and shall comply with *International Building Code* Section 1604.5 as Risk Category IV structures.

Reason: The proposed standard change clarifies the standard scope does not include post-event emergency shelters and correlates with Section 423.1.1 of the 2018 International Building Code.

Staff note: There is no Section 423.1.1 in the 2018 IBC. The text for Section 423.1.1 of the 2015 IBC has been incorporated into Section 423.1. Following is the text in the 2018 IBC:

> **423.1 General.** This section applies to the construction of storm shelters constructed as separate detached buildings or constructed as rooms or spaces within buildings for the purpose of providing protection from storms that produce high winds, such as tornadoes and hurricanes during the storm. Such structures shall be designated to be hurricane shelters, tornado shelters, or combined hurricane and tornado shelters. Design of facilities for use as emergency shelters after the storm are outside the scope of ICC 500 and shall comply with Table 1604.5 as a Risk Category IV Structure.

A question would be if the phrase "high winds during tornadoes and hurricanes" be viewed differently than "high winds, such as tornadoes and hurricanes during the storm."

Committee Action: Approval as Modified (14-0)
Reconsideration – Approval as Further Modified (9-0)

Further modify as follows:

101.2 Scope. This standard applies to the design, construction, installation and inspection of storm shelters constructed for the purpose of providing protection from the effects of high winds and associated hazards during tornadoes and hurricanes. Storm

shelters may be constructed as either ~~constructed as~~ separate, detached buildings or ~~constructed as~~ rooms or spaces within new or existing buildings. Shelters designed and constructed to this standard shall be designated as hurricane shelters, tornado shelters or combined hurricane and tornado shelters. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard ~~and shall comply with *International Building Code* Section 1604.5 as Risk Category IV structures~~.

Committee Reason: This provides coordination with the International codes for scope of the standard. "Associated hazard" was added to address things like debris impact. The revision in the 2nd sentence is editorial for better English. The deletion at the end is because this is addressed in the code and outside the scope of this standard.

Reconsideration

Further modify as follows:

101.2 Scope. This standard applies to the design, construction, installation and inspection of storm shelters constructed for the purpose of providing protection from ~~the effects of high winds and associated hazards during~~ tornadoes and hurricanes. Storm shelters may be constructed as either separate, detached buildings or rooms or spaces within new or existing buildings. Shelters designed and constructed to this standard shall be designated as hurricane shelters, tornado shelters or combined hurricane and tornado shelters. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard.

Reconsideration Reason: The intent is to remove "and associated hazards" so that the scope would not be extended past the original intent. This revision will allow for to address the hazards for storm surge, heaving rain on the shelter, loss of power to the shelter, etc.

IS-STM 01-01-18

STM 01-01-18		**Committee action: Approval as Further Modified**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**11**	**4**	**0**	**0**	**1**

Staff Notes: errata
Revise as follows:
101.2 Scope. This standard applies to the design, construction, installation and inspection of *storm shelters* constructed for the purpose of providing protection from tornadoes and hurricanes. *Storm shelters* shall be constructed as either separate detached buildings or rooms or spaces within new or existing buildings. *Storm shelters* designed and constructed to this standard shall be designated as *hurricane shelters*, *tornado shelters* or combined hurricane and *tornado shelters*. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard.

		Committee action: Approval as Further Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Ehrlich Vote:		**x**		

Your comment/reason: In implementing the approved language with modifications into the ballot draft, the word "from" in the first sentence was accidentally deleted:

Revise as follows:
101.2 Scope. This standard applies to the design, construction, installation and inspection of *storm shelters* constructed for the purpose of providing protection from tornadoes and hurricanes. *Storm shelters* shall be constructed as either separate detached buildings or rooms or spaces within new or existing buildings. *Storm shelters* designed and constructed to this standard shall be designated as *hurricane shelters*, *tornado shelters* or combined hurricane and *tornado shelters*. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard.

		Committee action: Approval as Further Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Levitan Vote:		**x**		

Your comment/reason: In the first sentence, the word 'from' has accidentally been stricken. The end of the sentence should read "…providing protection from tornadoes and hurricanes." as shown on page 10 of the Committee Actions Report

Revise as follows:
101.2 Scope. This standard applies to the design, construction, installation and inspection of *storm shelters* constructed for the purpose of providing protection from tornadoes and hurricanes. *Storm shelters* shall be constructed as either separate detached buildings or rooms or spaces within new or existing buildings. *Storm shelters* designed and constructed to this standard shall be designated as *hurricane shelters*, *tornado shelters* or combined hurricane and *tornado shelters*. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard.

		Committee action: Approval as Further Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:		**x**		

Your comment/reason: There is a discrepancy between the proposal as modified by the committee and the ICC 500 Clean Draft for ballot. Section 101.2 of the clean draft should state: "This standard applies to the design, construction, installation and inspection of storm shelters constructed for the purpose of providing protection **from** tornadoes and hurricanes."

Revise as follows:
101.2 Scope. This standard applies to the design, construction, installation and inspection of *storm shelters* constructed for the purpose of providing protection from tornadoes and hurricanes. *Storm shelters* shall be constructed as either separate detached buildings or rooms or spaces within new or existing buildings. *Storm shelters* designed and constructed to this standard shall be designated as *hurricane shelters*, *tornado shelters* or combined hurricane and *tornado shelters*. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard.

		Committee action: Approval as Further Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: Editorial - "from" was stricken in the first sentence and should be left ("…from tornadoes and hurricanes…")

Revise as follows:
101.2 Scope. This standard applies to the design, construction, installation and inspection of *storm shelters* constructed for the purpose of providing protection from tornadoes and hurricanes. *Storm shelters* shall be constructed as either separate detached buildings or rooms or spaces within new or

existing buildings. *Storm shelters* designed and constructed to this standard shall be designated as *hurricane shelters*, *tornado shelters* or combined hurricane and *tornado shelters*. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard.

		Committee action: Approval as Further Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC		**x**		

Your comment/reason: Transcribing error – keep the word "from" per 01-01-18.

Revise as follows:
101.2 Scope. This standard applies to the design, construction, installation and inspection of *storm shelters* constructed for the purpose of providing protection from tornadoes and hurricanes. *Storm shelters* shall be constructed as either separate detached buildings or rooms or spaces within new or existing buildings. *Storm shelters* designed and constructed to this standard shall be designated as *hurricane shelters*, *tornado shelters* or combined hurricane and *tornado shelters*. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard.

IS-STM 01-02-18
ICC 500 Sections 104.1 and 104.2

Proponent: Crystal Wespestad, representing self

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 normally be occupied for other purposes, the requirements of the applicable ~~building code~~ 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 Group 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 serves a specific building or buildings ~~*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*~~ shall be permitted to be classified as the same occupancy as the building served.

Reason:
Section 104.1 –The current term 'construction codes' is more all inclusive of requirements than just 'building code'. A building complies with many different construction codes, not just the building code. For example, the plumbing code and mechanical code use the occupancy to determine requirements for fixture counts and/or design of mechanical systems.

Section 104.2 – The current requirement for classifying buildings that are solely for storm shelters is to send you to Group A-3 (IBC 303.4). The exception as written with a reference to IBC Section 303 would still send you to Group A. For small shelters was the original reason is intended to match IBC 303.1.1 that lets you use Group B.? However, there are also several other options: Group B or the main occupancy (IBC 303.1.2), Group E (IBC 303.1.3) or A-3 religious worship (IBC 303.1.4) – each with different occupant loads. If the intent is to allow for other occupancies similar to the use of the buildings served, then have the exception allow the shelter to match the building served. The IBC already allows for multiple buildings on a site to be considered one building for purposes of construction requirements (IBC 503.1.2).
The proposal is written for any size, but the committee could limit the size if they wanted. I just saw no justification to do that – especially in relation to Group E where assembly spaces of any size associated with the Group E are Group E (IBC 303.1.3). Since this chapter is also applicable to residential chapters, this would also allow for residential shelters to comply with residential construction requirements.

Committee Action: As Modified (8-0)

Replace with the following:

Section 202
Definitions

APPLICABLE CODE. The regulation for design and ~~building~~ construction of buildings and structures adopted by the authority having jurisdiction over the construction of the specific shelter.

101.1 Purpose. 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. This standard is intended for adoption by government agencies and organizations for use in conjunction with ~~model~~ applicable codes to achieve uniformity in the technical design and construction of storm shelters.

101.3 Requirements not included. Where requirements are not provided by this standard, the applicable provisions of the ~~construction~~ applicable codes adopted by the authority having jurisdiction shall apply to the storm shelter.

104.1 Storm shelters within host buildings ~~Rooms or spaces within other uses~~. Where designated storm shelters are constructed as a room or space within a host building that will normally be occupied for other purposes, the requirements of the applicable ~~building~~ code for the occupancy of the building, or the individual rooms or spaces thereof, shall apply unless otherwise ~~stated in this standard~~ required by ICC 500..

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

Exceptions:

1. 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.*
2. Where the facility is a *residential storm shelter*, the designated occupancy shall be the Group R occupancy served as defined by the *International Building Code.*

SECTION 105
APPLICABLE ~~BUILDING~~ CODE
105.1 Applicable code. Where construction of a storm shelter is to take place where no applicable ~~construction~~ codes are adopted, the provisions of the *International Building Code* shall apply.

106.1 General. Construction of storm shelters and installation of all equipment shall be subject to inspections in accordance with the applicable ~~building~~ code.

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

106.2.1 Inspection of fabricators. Where fabrication of structural load-bearing and debris-impact-resistant components and assemblies is being performed on the premises of a fabricators shop, special inspection of the fabricator shall be provided. **Exception:** Prefabricated or panelized storm shelter components that have been inspected and labeled by an approved agency meeting the requirements of the applicable ~~building~~ code.

106.4 Structural observations. During construction of community shelters, the building owner shall employ a registered design professional to conduct visual observations of the construction of the structural system for general conformance to the approved construction documents at significant construction stages and at completion of the construction of the structural system. Structural observation shall not obviate the need for other inspections or testing required by this standard or the applicable ~~building~~ code.

Deficiencies shall be reported in writing to the owner and to the authority having jurisdiction. At the conclusion of the work, the registered design professional who made the structural observations shall submit to the authority having jurisdiction a written statement that the site visits have been made and shall identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

107.1 General. Where required by the authority having jurisdiction, construction documents shall be prepared. Such documents shall contain information as required by the applicable ~~building~~ code and this section.

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 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.

107.3.3 Contractor responsibility. Each contractor responsible for the construction, fabrication or installation of a main windforce-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 the 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 compliance 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: Fabrication of storm shelter components that have been inspected and labeled by an approved agency as meeting the requirements of the applicable ~~building~~ code and this standard.

301.1 Scope. Loads and load combinations shall be determined in accordance with ASCE 7 unless otherwise noted. Structural elements of the storm shelter shall be designed in accordance with the appropriate material design standard specified in the applicable ~~building~~ code to sustain the loads prescribed in ASCE 7, as modified by this chapter, and combined in accordance with the load combinations of ASCE 7, as modified by Section 302.

301.1.1 Design or testing. Where the strength requirements cannot be determined by engineering calculations in accordance with appropriate material design standards referenced by the applicable ~~building~~ code, roof and wall assemblies shall meet the pressure requirements of Section 805.

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 that are fully enclosed in a host building constructed in compliance with the local applicable ~~building~~ code.

309.1 Penetrations of storm shelter envelope by mechanical, electrical and plumbing systems. Penetrations through the storm shelter envelope of mechanical, electrical and plumbing systems, including piping and utility lines, larger than 31/2 square inches (2258 mm2) in area for rectangular penetrations or 21/16 inches (52.38 mm) in diameter, 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 applicable codes and standards governing such utility lines.

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 are not required to have an emergency escape opening.

501.3 Direction of swing. The direction of the swing of doors shall be as required by the applicable ~~building~~ code for the normal occupancy of the space.

601.1 Fire separation. Fire barriers and horizontal assemblies separating spaces or areas designated as storm shelters from other building areas shall have a minimum fire-resistance rating of 2 hours and shall be constructed in accordance with the applicable ~~building~~ code.
Exception: Fire separation assemblies are not required for residential shelters.

702.1.2 Mechanical ventilation. Tornado shelters that rely on mechanical ventilation shall be provided with the minimum mechanical ventilation rate of required outdoor air in accordance with the applicable ~~building~~ code provisions for the normal use of the space. The mechanical ventilation system shall be connected to an emergency power system.

703.1.1 Mechanical ventilation. The minimum mechanical ventilation rate of required outdoor air shall be determined in accordance with the applicable ~~building~~ code provisions for the normal use of the space.

Committee Reason: Revisions are for consistency in language related to the building code and matching the Groups in the 2021 IBC.

IS-STM 01-02-18

STM 01-02-18		**Committee action: Approval as Modified**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**14**	**1**	**0**	**0**	**0**

Staff Notes: The ICC 500 does not define 'dwelling' or 'townhouse' as IBC and IRC do. An alternative to the new exception in Section 105.1 would be to revise as follows:

105.1 *Applicable code*. Where construction of a *storm shelter* is to take place where no *applicable codes* are adopted, the provisions of the *International Building Code* or the *International Residential Code* as applicable, shall apply.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Ehrlich Vote:		**x**		

Your comment/reason: IS-STM 01-10-18 was amended by the committee to reflect a new exception to the default Group A-3 occupancy classification for dedicated residential storm shelters serving buildings classified as Group R under the IBC added for the 2021 IBC by proposal G59-18. The exception addresses congregate living facilities, lodging houses and custodial care facilities housed in buildings with one or two dwelling units and 16 or fewer occupants classified as Group R-3 or R-4 under the IBC and was intended to prevent any possible issues that might stem from having a Group B (as permitted

by Exception #1) structure adjacent or accessory to a Group R building.

What didn't get addressed is the IRC also calls ICC-500 directly via Section R323 and prefabricated, dedicated shelters installed in-ground in the yard or bolted to the slab in a garage are the most popular and cost-effective options. To head off any potential issues caused by having a structure technically classified as Group B (or now Group R) occupying the same lot as an IRC-compliant dwelling, appropriate references to the IRC are supplied for ICC 500 Sections 104.2 and 105.1:

Revise as follows:

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

Exceptions:

1. Where the facility has a *storm shelter design occupant capacity* 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*.
2. Where the facility is a *residential storm shelter*, the designated occupancy shall be the Group R occupancy served as defined by the *International Building Code* or the facility shall comply with the *International Residential Code*, as applicable.

105.1 *Applicable code*. Where construction of a *storm shelter* is to take place where no *applicable codes* are adopted, the provisions of the *International Building Code* shall apply.

Exception: Where construction of a *residential storm shelter* is to take place where no *applicable codes* are adopted and within or accessory to a detached one- or two-family dwelling or townhouse not more than three stories above grade plane in height with a separate means of egress, the provisions of the *International Residential Code* shall apply.

IS-STM 01-11-18
ICC 500 Section 106.2

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

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

~~106.3~~ 106.2.2 Special cases. *(No change to text)*

~~106.3.1~~ 106.2.2.1 Special inspections to verify anchor installation. *(No change to text)*

~~106.4~~ 106.3 Structural observations. *(No change to text)*

Reason: This standard change proposal seeks to ensure that storm shelters be subject to the same special inspections required for other buildings in accordance with the applicable building code. Because of their life-safety protection purpose, storm shelters should be held to equal or higher inspection standards than other buildings. Section 1705 of the 2015 IBC provides for special inspections of special cases at the discretion of the building official, but most other conditions that trigger special inspections are clearly defined and include case-specific exceptions. The existing language in the ICC 500 that is proposed to be deleted obscures the need for other special inspections in accordance with the applicable building code. Section 106.3.1 provides an exception from special inspections required to verify residential storm shelter anchor installation when the authority having jurisdiction verifies anchorage and foundation, where required.

Committee Action: Approved as Submitted (10-0)

Committee Reason: Clarification and minor reorganization to streamline this section

IS-STM 01-11-18

STM 01-11-18		Committee action: As Submitted			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**14**	**1**	**0**	**0**	**0**
Staff Notes: Section 1110.1.2.1 in the ICC 500 draft also addresses special inspections of anchor installation. **110.1.2.1 *Special inspections* to verify anchor installation.** A *special inspection* shall be provided					

to verify the post-installed anchor installation and capacity in accordance with Section 106.2.1. For post-installed anchorage to foundations, *special inspection* shall be provided to verify foundation adequacy in accordance with Sections 106.2.1 and 307.

Exception: For *residential storm shelters*, where the *authority having jurisdiction* verifies that the anchorage and, where required, the foundation complies with the requirements of the *storm shelter* design as provided in documentation required by Section 106, *special inspection* is permitted to be waived by the *authority having jurisdiction*.

		Committee action: As Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Szoke Vote:		**X**		

Your comment/reason:

Adequate inspection of post-installed anchors is essential to assure proper structural performance. Problems with the performance of anchors has resulted in new anchor requirements in ACI 318 *Building Code Requirements for Structural Concrete*. Since the performance of the structure during event conditions is reliant on the connections of structural elements, especially those to foundation elements, it is important to ensure that post-installed anchors are properly installed. This provision places necessary emphasis on the need for such inspections and also adds additional qualified individuals to perform such inspections so that all inspections need not be conducted by a design professional. This is intended to assure proper inspection but also to keep costs of the necessary inspections as low as possible

My intent is to help assure it is understood that the pool of qualified anchor installation inspectors is larger than just the design professionals. Further, many special inspectors for normal construction requiring inspection as not necessarily qualified to conduct anchor inspections. Anchor installation inspection is more than frequency of placement. There have been some serious problems with post installed anchors and our committees responded by developing this rigorous certification program. Personally I believe even the design professional should be certified for these connections, but I know that is a reach.

Maybe a preferred approach for this edition is:

> 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. <u>An individual with current credentials as an American Concrete Institute certified post-installed concrete anchor installation inspector shall be considered qualified for post-installed anchor inspections.</u>

Add new Section as follows:

<u>111.1.1 Post-installed anchors.</u> <u>For community storm shelters post-installed anchors connecting structural elements to concrete foundation systems or concrete structural elements shall be inspected by a registered design professional or an American Concrete Institute certified post-installed concrete anchor installation inspector.</u>

IS-STM 01-12-18
ICC 500 Section 106.2

Proponent: Benchmark Harris, The National Storm Shelter Association (NSSA) Design Practices Committee

Revise as follows:

106.2 Special inspections. Special inspections shall be provided for construction and installation of materials as required by the authority having jurisdiction in accordance with the applicable building code and Section 106.3 of this standard. One statement of special inspections shall be permitted to apply to both host and shelter construction.

Exception: Special inspections and tests are not required for storm shelter construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.

Reason:

Chapter 17 of the 2018 IBC requires that the Design Professional In Responsible Charge submit a statement of special inspections. ICC 500-2014 Section 107.3 requires a quality assurance plan that can be a part of the overall statement of special inspections or can be a separate plan dedicated to the shelter construction. Some design professionals may believe that having one unified plan makes it easier for all parties to understand and complete. The proposed revision clarifies that it shall be permitted for there to be one unified plan if desired.

The proposed exception is based on thfe exception to Section 1704.2 "Special inspections and tests" in the 2018 IBC, which states, "Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official." This important exception grants Building Officials broad authority to modify requirements for special inspections and tests when deemed acceptable to the Building Official. It is appropriate to reiterate this exception because one could mistakenly interpret the requirements of ICC 500 related to quality assurance to be mandatory without exception and not subject to such exceptions that building officials may deem acceptable. For example, concrete tilt-wall panels can have panel-to-panel connections for serviceability control of out-of-plane panel deflections which the Structural Engineer who designed the panels may not have relied on for structural resistance, which could make them work of a minor nature in the opinion of the Structural Engineer. As the Structural Engineer creates his or her portion of the statement of special inspections and submits it to the Architect; the Architect could then submit the overall statement of special inspections to the Building Official on the construction documents (for example, in the project manual) with no inspections required for those panel-to-panel connections; the Building Official could then issue a building permit as indication in accordance with 2018 IBC Section 15.3.1 that the Building Official is "satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto" which approves the statement of special inspections. The same exception can appropriately be used for other conditions where the Building Official deems conditions warrant.

Committee Action: Modification: Delete exception (7-2)
Approval as modified (9-0)

Further modify as follows:

106.2 Special inspections. Special inspections shall be provided for construction and installation of materials as required by the authority having jurisdiction in accordance

with the applicable building code and Section 106.3 of this standard. One statement of special inspections shall be permitted to apply to both host building and shelter construction.

~~Exception:~~ ~~Special inspections and tests are not required for storm shelter construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.~~

Committee Reason: The purpose of removal of the exception is because this language is already permitted in Chapter 17 of the IBC. This should be included in commentary for this section – right now there is a conflict in the commentary. The added sentence is a reasonable clarification of requirements.

IS-STM 01-12-18

IS-STM 01-12-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	0
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Schultz Vote:		x		

Your comment/reason: The allowance of one statement of special inspections be permitted should have a reference to section *107.3 Quality assurance plan preparation*, otherwise, it may get lost or be provided in a separate document.

No revision suggested. Highlight is this change.

110.1 *Special inspections*. *Special inspections* shall be provided in accordance with this section, in addition to those required by the *authority having jurisdiction* in accordance with the *applicable code*. One statement of *special inspections* shall be permitted to apply to both *host building* and *storm shelter* construction.

Staff note: Section 107.3 does reference 110.1.

107.3 Quality assurance plan preparation. A quality assurance plan prepared by a registered design professional shall be provided for each main wind-force resisting system and each wind-resisting component.

The quality assurance plan shall identify the following:

1. The main wind-force resisting systems and wind-resisting components.
2. The *special inspections* and testing to be required in accordance with Section 110.1.
3. The type and frequency of testing required.
4. The type and frequency of *special inspections* required.
5. The structural observations to be performed in accordance with Section 111.1.
6. The required distribution, type and frequency of reports of test, inspections and structural observations.

IS-STM 01-13-18
ICC 500 Section 106.5(New)

Proponent: John Roberts, UL LLC

Revise as follows:

106.5 Inspection, maintenance, and repairs. Storm shelters shall be inspected and maintained as follows:

1. Storm shelters shall be inspected annually to verify that the walls and roofs are intact and undamaged, and shelter door hardware and door operation function as required in this standard.
2. Any damage to the storm shelter or its impact-protective systems shall be repaired or replaced in accordance with this standard. Missing equipment or components shall be replaced.
3. Where it is necessary to replace impact-protective systems, including certified doors, shutters, windows or their frames, hardware, and closing mechanisms, replacements shall comply with applicable requirements of this standard.

Reason: It is appropriate to include basic inspection, maintenance and repair requirements in ICC 500.

Staff note: Questions that have come up in other standards related to maintenance and repairs are to who is going to do the inspections, and how will records be maintained to show those inspections have been done. As an example, ICC 300 includes inspection, maintenance and repairs in Section 105 and Chapter 5.

Committee Action: As Modified (9-0)

Replace with the following:

SECTION 110
EVALUATION, MAINTENANCE, AND REPAIRS

110.1 General. Community shelters shall be evaluated and maintained in accordance with this section and ICC 500.

110.2 Evaluation. The owner or owner's representative shall evaluate the storm shelter annually and when requested by the authority having jurisdiction. The evaluation of the storm shelter shall include the following:

1. The storm shelter envelope shall be evaluated to verify that the walls and roofs appear undamaged and in good repair.
2. Impact protective systems shall be evaluated for compliance with the manufacturer's operational and maintenance requirements.

110.3 Maintenance and Repairs. Storm shelters shall be maintained in an operable condition at all times. All structural and operational elements shall be repaired or replaced where damaged or found to be inoperable.

110.3.1 Damaged or missing components. Storm shelters shall be maintained so that walls and roofs are intact and undamaged. Any damage to the storm shelter or its impact-protective systems that impair its functionality shall be repaired or replaced. Damaged or missing components shall be replaced with components that were originally approved within the tested assembly being repaired.

110.3.2 Replacement assemblies and systems. Where it is necessary to replace certified or listed impact-protective systems, replacements shall comply with applicable ICC 500 requirements, and shall be tested and installed as required by this standard for new installations or construction.

110.4 Recordkeeping. A record of the evaluations shall be maintained by the owner or owner's representative. A record of the evaluations, and any other tests, repairs or replacements, and other operations and maintenance shall be kept on the premises or other *approved* location, such as an operations manual, and should consist of all changes to the original shelter envelope or impact protective systems. Records must include the date and person conducting the evaluations and maintenance or repairs.

Committee Reason: The purpose of this new section is for periodic evaluations. If the evaluation finds something damaged, repairs are required. The commentary should include recommendations to communicate with the people operating the shelter (if different from the owner), so they know when the shelter is not available for use. There is the question to if a repair could restore the shelter to the edition of the standard it was constructed under vs. the current edition of the standard.

IS-STM 01-13-18

IS-STM 01-13-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	12	2	1	0	1
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		
Your comment/reason: I don't think we need to specify ICC 500, since this **is** ICC-500! **Revise as follows:** **113.1 General.** Community shelters shall be evaluated and maintained in accordance with this section ~~and ICC 500~~.				

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:		x		
Your comment/reason: a. Is the 'ICC 500' needed at the end of section 113.1? More helpful to provide specific sections? **Revise as follows:**				

113.1 General. Community shelters shall be evaluated and maintained in accordance with ~~this section and ICC 500~~ Sections 113.2 through 113.4.

b. Need to remove permissive language “should” and suggest replace ‘must’ with ‘shall’ in 113.4. (see blue below) Also in 113.4, I don’t think an ‘operations manual’ is really a good example of an approved location to store evaluations and repair/replacement info We talk about an emergency operations plan in Section 108.2, but never mention anything about an ‘operations manual’. Need better example or delete.

Revise as follows:

113.4 Recordkeeping. A record of the evaluations shall be maintained by the owner or owner’s representative. A record of the evaluations, and any other tests, repairs or replacements, and other operations and maintenance shall be kept on the premises or other *approved* location, ~~such as an operations manual,~~ and ~~should~~ consist of all changes to the original shelter envelope or impact protective systems. Records ~~must~~ shall include the date and person conducting the evaluations and maintenance or repairs.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:			**x**	

Your comment/reason:
In Section 110.2 (113.2 of Clean Draft), the added phrase “appear undamaged and in good repair” is vague and not an improvement over the proposal as submitted. Consider reverting to the language “… are intact and undamaged”, which is used in Section 110.3.1 (Section 113.3.1). Also, in Section 110.4 (113.4), replace both “should” in the second sentence and “must” in the last sentence with “shall”.

Revise as follows:

113.2 Evaluation. The owner or owner’s representative shall evaluate the storm shelter annually and when requested by the authority having jurisdiction. The evaluation of the storm shelter shall include the following:

3. The storm shelter envelope shall be evaluated to verify that the walls and roofs ~~appear undamaged and in good repair~~ are intact and undamaged.
4. Impact protective systems shall be evaluated for compliance with the manufacturer’s operational and maintenance requirements.

113.3.1 Damaged or missing components. Storm shelters shall be maintained so that walls and roofs are intact and undamaged. Any damage to the storm shelter or its impact-protective systems that impair its functionality shall be repaired or replaced. Damaged or missing components shall be replaced with components that were originally approved within the tested assembly being repaired.

113.4 Recordkeeping. A record of the evaluations shall be maintained by the owner or owner’s representative. A record of the evaluations, and any other tests, repairs or replacements, and other operations and maintenance shall be kept on the premises or other *approved* location, such as an operations manual, and ~~should~~ shall consist of all changes to the original shelter envelope or impact protective systems. Records ~~must~~ shall include the date and person conducting the evaluations and maintenance or repairs.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason:
For 113.2 - Add “as necessary”
For 113.1.1 - Delete “originally” as this could mean a lot of things and may not be accurate. Delete “being repaired”.

Revise as follows:

113.2 Evaluation. The owner or owner’s representative shall evaluate the storm shelter annually, as necessary, and when re- quested by the authority having jurisdiction. The evaluation of the storm shelter shall include the following:

1. The storm shelter envelope shall be evaluated to verify that the walls and roofs appear undamaged and in good repair.
2. Impact protective systems shall be evaluated for compliance with the manufacturer’s operational and maintenance requirements.

113.3.1 Damaged or missing components. Storm shelters shall be maintained so that walls and roofs are intact and undamaged. Any damage to the storm shelter or its impact-protective systems that impair its functionality shall be repaired or replaced. Damaged or missing components shall be replaced with components that were ~~originally~~ approved within the tested assembly ~~being repaired~~.

IS-STM 01-14-18
ICC 500 Section 107.1

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

107.1 General. ~~Where required by the authority having jurisdiction,~~ For all storm shelters, construction documents shall be prepared and submitted to the authority having jurisdiction for building permit purposes. Such documents shall contain information as required by the applicable building code and this section.

Reason: Requiring preparation of the construction documents as required by the applicable building code and Section 107 for all storm shelters will provide a greater level of quality assurance for life safety protection to all storm shelter occupants. At present, only storm shelters designed and constructed in jurisdictions that actively request the specified construction documents can be certain to benefit from the construction documentation criteria in ICC 500 which are intended to ensure that all relevant standard requirements have been considered by the appropriate parties.

Committee Action: Approved as Modified (11-0)

Replace with the following:

107.1 General. ~~Where required by the authority having jurisdiction,~~ For all storm shelters, construction documents shall be prepared and submitted to the authority having jurisdiction with each permit application. Such documents shall contain information as required by the applicable building code and this section.

Committee Reason: Modification for "each permit application" is for consistency with IBC language. All storm shelters should have permits due to the high performance expectations.

IS-STM 01-14-18

IS-STM 01-14-18		**Committee action: Approval as Modified**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**13**	**2**	**0**	**0**	**0**
Staff Notes: Scott's comment is errata.					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Ehrlich Vote:		**x**		

Your comment/reason: Since ICC-500 encompasses requirements for all types of storm shelters – hurricane, tornado and both, commercial and residential – the initial clause "for all storm shelters" seems unnecessary. It is also noted IBC Section 107.1 on Submittal Documents and IRC Section 106.1 on Construction Documents clarify the items that are included in "submittal documents". Suggest 106.1 be revised for consistency:

Revise as follows:

106.1 General. ~~For all *storm shelters*,~~ Submittal documents consisting of construction documents, test reports, peer review reports and other data shall be prepared and submitted to the *authority having jurisdiction* with each permit application. Such documents shall contain information as required by the *applicable code* and this section. Storm shelter construction documents, including the design information listed in Section 106.2.1, shall be prepared and sealed by a registered design professional.

Exception: The following items that are *listed* and *labeled* to indicate compliance with ICC 500 are not required to comply with this section:
1. Residential storm shelters
2. Structural components and *impact-protective systems* installed in residential storm shelters.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: Editorial - Section 106.1, reference to Section 107.2.1 should be 106.2.1

Revise as follows:
106.1 General. For all *storm shelters*, submittal documents shall be prepared and submitted to the *authority having jurisdiction* with each permit application. Such documents shall contain information as required by the *applicable code* and this section. Storm shelter construction documents, including the design information listed in Section ~~107.2.1~~ 106.2.1, shall be prepared and sealed by a registered design professional.

Exception: The following items that are *listed* and *labeled* to indicate compliance with ICC 500 are not required to comply with this section:
1. Residential storm shelters
2. Structural components and *impact-protective systems* installed in residential storm shelters.

IS-STM 01-15-18
ICC 500 Section 107.1.1(New)

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

107.1.1 Shelter design drawings. Where required by the authority having jurisdiction, shelter design drawings, including the design information listed in Section 107.2.1, shall be prepared and sealed by a registered design professional licensed in accordance with the state laws for the state where the storm shelter will be constructed or installed.

Reason: This proposed standard change would ensure that the storm shelter design was completed and/or reviewed by a registered design professional for the specific site where the storm shelter is to be installed. This is similar to the requirement in the IBC for flood hazard documentation.

> **"1612.5 Flood hazard documentation.** The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:"

Staff note: A question would be if "including the design information listed in Section 107.2.1," was redundant since Section 107.2.1 says that this information has to be provided on the construction documents.

IBC includes the following:

> **[A] 107.1 General.** Submittal documents consisting of *construction documents*, statement of *special inspections*, geotechnical report and other data shall be submitted in two or more sets with each *permit* application. The *construction documents* shall be prepared by a *registered design professional* where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the *building official* is authorized to require additional *construction documents* to be prepared by a *registered design professional*.
>
> **Exception:** The *building official* is authorized to waive the submission of *construction documents* and other data not required to be prepared by a *registered design professional* if it is found that the nature of the work applied for is such that review of *construction documents* is not necessary to obtain compliance with this code.

Committee Action: As modified (6-0 meeting) (10-1 electronic vote)

Replace with the following:

107.1 General. For all storm shelters, construction documents shall be prepared and submitted to the authority having jurisdiction with each permit application. Such documents shall contain information as required by the applicable building code and this section. Storm shelter construction documents, including the design information listed in Section 107.2.1, shall be prepared and sealed by a registered design professional.

Exception: The following items that are listed and labeled to indicate compliance with ICC-500 are not required to comply with this section:

1. Residential storm shelters
2. Structural components and impact-protective systems installed in residential storm shelters.

Committee Reason: The "authority having jurisdiction" provides the criteria for what documents has to be signed and sealed. Section 107.2.1 is a list of construction documents, which may include specifications. The exception allows for residential shelters to have all or a portion listed and labeled by a recognized agency (ex: UL). The language is modified to be consistent with IRC proposal RB146-19, which as Approved.

IS-STM 01-15-18

IS-STM 01-15-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	12	2	1	0	0
Staff Notes: Scott vote is editorial					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		

Your comment/reason: The approved version of IS-STM 01-15-18 incorporated the exception to signed and sealed construction documents for listed and labeled components approved for the 2021 IRC via proposal RB146. In the IRC, the basic requirements for CD's and the requirement for signed and sealed CD's are in different sections. They are merged here, and thus as written the exception could be taken to exempt listed and labeled residential storm shelters or their components from needing submittal documents entirely, which was not the intent of the proponents. Suggest 106.1 be revised to clarify the exception:

Revise as follows:

106.1 General. For all *storm shelters*, construction submittal documents shall be prepared and submitted to the *authority having jurisdiction* with each permit application. Such documents shall contain information as required by the *applicable code* and this section. Storm shelter construction documents, including the design information listed in Section 106.2.1, shall be prepared and sealed by a registered design professional.

Exception: Where the ~~The~~ following items ~~that~~ are *listed* and *labeled* to indicate compliance with ICC 500 construction documents are not required to be prepared and sealed by a registered design professional ~~comply with this section~~:
1. Residential storm shelters.
2. Structural components and *impact-protective system*s installed in residential storm shelters.

Staff note: exception has incomplete wording

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Roeper Vote:			x	

Your comment/reason: The exception for items that are listed and labeled should not be limited to installations in residential storm shelters.

Revise as follows:

106.1 General. For all *storm shelters*, submittal documents shall be prepared and submitted to the *authority having jurisdiction* with each permit application. Such documents shall contain information as required by the *applicable code* and this section. Storm shelter construction documents, including the design information listed in Section 106.2.1, shall be prepared and sealed by a registered design professional.

Exception: The following items that are *listed* and *labeled* to indicate compliance with ICC 500 are not required to comply with this section:

1. Residential storm shelters.
2. Structural components and *impact-protective systems* ~~installed in residential storm shelters~~.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		
Your comment/reason: Editorial – Section 106.1, period at end of exception 1				

IS-STM 01-16-18
ICC 500 Section 107.2.1

Proponent: Corey Shultz, Schultz Squared Architects LLC

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: Residential or community tornado, hurricane or a combination of both.
2. Use of community shelter: Specific use, public use, or a combination of both.
~~2.~~3. 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.~~4. The shelter design wind speed, mph.
~~4.~~5. The wind exposure category (indicate all if more than one is used).
~~5.~~6. The internal pressure coefficient, GC*pi*.
~~6.~~7. The topographic factor, *Kzt*.
~~7.~~8. The directionality factor, *Kd*.
~~8.~~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.
~~9.~~10. The Design Flood Elevation and Base Flood Elevation for the site (if applicable).
~~10.~~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.
~~11.~~12. A floor plan drawing or image indicating location of the storm shelter on a site or within a building or facility; including a drawing or image indicating the entire facility.
~~12.~~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 maximum designed occupant load of the storm shelter.
~~15.~~16. Calculations for the usable storm shelter floor area.
~~16.~~17. Calculations for the venting area (square inches) provided and locations in the shelter.
~~17.~~18. Calculations for the number of sanitation facilities for community shelters.
~~18.~~19. Minimum foundation capacity requirements.

~~19.~~20. Shelter installation requirements including anchor location and minimum required capacity for each anchor.
~~20.~~21. For hurricane shelters, the rainfall rate of the roof primary drainage system.
~~21.~~22. For hurricane shelters, the rainfall rate of the roof secondary (overflow) drainage system where required.
~~22.~~23. For hurricane shelters, the rainwater drainage design rainfall rate for facilities subject to rainwater impoundment.

Reason: Item 2: Shelters are designed for either specific use, public use, or a combination i.e. public use when shelter is not utilized for specific use. Many code standard items are based on the number of occupants like usable area, ventilation, and sanitation facilities. Use may also affect additional signage types and locations for way finding purposes for the intended public occupants. A shelter may be designed for specific use and the shelter Owner may at a later date change it to a public use or combination. At that point, the shelter size and infrastructure may not be designed to support the possible increase in occupants. This proposed revision requires documentation of the use of the shelter to notify code officials, and shelter Owners/managers, present and future the original design intent for shelter use. This can also protect designers from being held responsible for potential ramifications of change of use.

Item 15 (previous item 14). The intent of this proposed revision is to notify shelter Owners/managers the number of occupants the shelter has been designed hence, usable area of shelter, number of exits, ventilation, and number of toilets. If there is a future change in the number of occupants intended to utilize the shelter, this will notify all stakeholders of potential revisions that may need to occur to support this increase which may require additional shelter space.

Item 16 (previous item 15). For the purposes of peer reviews and for assisting code officials, showing how the designer has determined the useable space is very important. This is to verify the calculation method utilized, if the proper usability factor has been utilized or if utilizing the optional net area calculation, what items have been removed for usable area. Based on the current requirement, the design team may note a total usable area alone making verification of the usable space by the peer reviewer and/or code official difficult. The proposed revision would require documenting the design team's usable area calculations.

Item 17 (previous item 16). For the purposes of peer reviews and for assisting code officials, showing how the designer has determined the amount of ventilation assists in verifying the method utilized, and if the design complies with the standard. Based on the current requirement, the design team may note a total ventilation area leaving the calculations for the peer reviewer and the code official.

Committee Action: As submitted (5-0 meeting, 12-0 electronic vote)

Committee Reason: Maximum occupant load should also be added to the Chapter 5 requirements for coordination. Specific use and public use may need a definition. The committee agreed with the proponents reason.

IS-STM 01-16-18

IS-STM 01-16-18		**Committee action: As Submitted**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**11**	**4**	**0**	**0**	**1**

Staff Notes:

		Committee action: As Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		

Your comment/reason: IS-STM 01-16-18 intended to clarify the occupant load of the storm shelter required to be provided as part of the design information on the construction documents is the "maximum designed". IS-STM 05-18-18 introduced the term "storm shelter design occupant capacity" and implemented the term throughout ICC-500, creating an unnecessarily redundant reference in Item #16 of 106.2.1 to the "maximum designed…design…capacity".

Revise as follows:
106.2.1 Design information…..
16. The maximum ~~designed~~ *storm shelter design occupant capacity*.

		Committee action: As Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:		x		

Your comment/reason:

a. The word 'designed' was approved here, but it is redundant based on later changes to terminology and needs to be deleted in item 16 of 106.2.1, so that the sentence should now read

Revise as follows:

106.2.1 Design information…..
16. The maximum ~~designed~~ *storm shelter design occupant capacity*.

b.The definition of Community Shelter intended uses has terminology inconsistent with that of Item 2 of 106.2.1. In one case we use general public vs public use (that's at least not too far off and users could probably make the connection that they were the same thing). The other category is termed either 'specific use' or 'building occupants'. It is not clear at all, without commentary, that those two terms are referring to the same thing. We need to harmonize the language here between these two sections and any other locations that refer to these distinctions of types of community shelter.

No specific language suggested. Highlights for emphasis.

Community Storm Shelter. Any storm shelter not defined as a residential storm shelter. This includes both storm shelters intended for use by the general public and storm shelters intended for use by building occupants.

106.2.1 Design information…..
2. Use of *community storm shelter*: Specific use, public use, or a combination of both.

Staff note: The last sentence in the definition of Community storm shelter was added by IS-STM 10-013-18.

		Committee action: As Submitted		
	Affirmative	Affirmative with	Negative with	Abstain with

		comment	comment	reason
Manley Vote:		x		

Your comment/reason: In Section 106.2.1 (Clean Draft), new item 16, which reads "The maximum designed storm shelter design occupant capacity." seems awkward. Consider deleting the first word "designed".

Revise as follows:
106.2.1 Design information…..
16. The maximum ~~designed~~ *storm shelter design occupant capacity*.

	Committee action: As Submitted			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		x		

Your comment/reason: Section 106.2.1, Editorial - #18 for consistency with #4 we should change "(square inches)" to ", in^2 (cm^2)" (guessing cm is what would be used?) and move it to the end after a comma. Also add ", ft^2 (m^2)" at the end of #17.

Revise as follows:
106.2.1 Design information…..
4. The *storm shelter design wind speed*, V, mph (m/s).
16. The maximum designed *storm shelter design occupant capacity*
17. Calculations for the *usable storm shelter floor area*, ft^2 (m^2).
18. Calculations for the venting area, in^2 (mm^2) ~~(square inches)~~ provided and locations in the *storm shelter*.

	Committee action: As Submitted			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		x		

Your comment/reason: This was proposed during discussions, but never acted on.

Add new section as follows:

106.2.2 Design information documentation. Design information listed in Section 106.2.1 and instructions listed in Section 106.2.6 shall be documented or referenced on a single sheet within the construction documents.

IS-STM 01-20-18
ICC 500 Section 107.2.6

Proponent: Corey Shultz, Schultz Squared Architects LLC

Revise as follows:

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

1. Type and location of equipment and amenities required within the shelter, including water supply, sanitary facilities, fire extinguishers, batteries, flashlights, special emergency lighting equipment or any other equipment required to be installed in the shelter.
2. Specifications for any alarm system to be installed.
3. Instructions for the installation or deployment of any special protection equipment such as shutters, screens, ~~special~~ latching or locking of doors or windows, any equipment or switching for mechanical, electrical and plumbing equipment.

Reason: There is currently a disconnect between the systems that designers are designing/specifying and how they are intended to be utilized by the end users i.e. instructions may not be provided to the shelter owners, managers, or occupants. The word "Special" is not defined and consequently, many architects ignore this because for example, they do not feel closing and locking a shelter door to disengage the exterior hardware trim, moving a switch on door hardware to change the hardware from normal to emergency mode, or instructing end users where the shelter ventilation switch is located or when the ventilation system should be engaged is a "special" instruction. Many designers do not understand what they have designed/specified nor how they function. The requirement to document instructions on how to utilize the systems will assist both the design team and shelter owner/manager to understand how to engage the shelter systems per the intent of the design. Understanding the way the systems is intended to operate will assist in determining if systems need maintenance. It will also provide information to shelter owners/managers that can and should be included in shelter management plans. Documenting these instruction will also provide future reference to other follow up designers, and shelter owners/managers as to the intended use of the systems.

Committee Action: As submitted (5-0 meeting, 12-0 electronic vote)

Committee Reason: Agree with proponents reason.

IS-STM 01-20-18

IS-STM 01-20-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	1
Staff Notes:					

		Committee action: As Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: Section 106.2.6, Ch 3 didn't catch this when we were working on impact-protective system definition and where changes would need to be make throughout, #3 includes "special protection equipment" and sounds like that should be "impact-protective systems".

Revise as follows:

106.2.6 *Storm shelter* instructions. The construction documents shall provide or include any details or instructions required for the functional operation of the *storm shelter*, such as:

4 Type and location of equipment and amenities required within the *storm shelter*, including water supply, sanitary facilities, fire extinguishers, batteries, flashlights, special emergency lighting equipment or any other equipment required to be installed in the *storm shelter*.
5 Specifications for any alarm system to be installed.
6 Instructions for the installation or deployment of any ~~special protection equipment~~ impact-protective equipment such as shutters, screens, latching or locking of doors or windows, any equipment or switching for mechanical, electrical and plumbing equipment.

		Committee action: As Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason: Can we remove 'special' from 106.2.5 to coordinate with the same change to 106.2.6.

Revise as follows:

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

106.2.5 ~~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*.

106.2.6 *Storm shelter* instructions. The construction documents shall provide or include any details or instructions required for the functional operation of the *storm shelter*, such as:

1 Type and location of equipment and amenities required within the *storm shelter*, including water supply, sanitary facilities, fire extinguishers, batteries, flashlights, special emergency lighting equipment or any other equipment required to be installed in the *storm shelter*.
2 Specifications for any alarm system to be installed.
3 Instructions for the installation or deployment of any ~~special~~ protection equipment such as shutters, screens, latching or locking of doors or windows, any equipment or switching for mechanical, electrical and plumbing equipment.

IS-STM 01-21-18

ICC 500 Sections 107.3.3, 109(New), 110(New), 202, 402, 402.1, 702.4, 703.7

Proponent: Daniel A. Dain, AIA, representing Stantec Architecture Inc.

Revise as follows:

SECTION 109 CONTRACTOR RESPONSIBILITY.

109.1 ~~**107.3.3**~~ **Contractor responsibility.** Each contractor responsible for the construction, fabrication or installation 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 the 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 compliance 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: Fabrication of storm shelter components that have been inspected and labeled by an approved agency as meeting the requirements of the applicable building code and this standard.

SECTION 110 OWNER RESPONSIBILITY.

110.1 Owner Responsibility. For each community shelter, the owner shall submit a written statement of responsibility to the authority having jurisdiction with the application for a construction permit. The owner's statement of responsibility shall contain:

1. Acknowledgement of the owner's responsibilities regarding shelter operation and maintenance.
2. The name and contact information of the owner's designated representative as shelter manager who is directly responsible for shelter operation and maintenance.

SECTION 202 DEFINITIONS:

~~**LOCAL EMERGENCY PLANNING COMMITTEE.** A group of citizens defined by the community as having responsibility for local emergency planning. The committee shall be recognized by the governing body as having this responsibility.~~

~~**SECTION 402 HAZARDOUS MATERIALS.**~~

~~**402.1 Proximity to hazardous materials.** Occupants of community shelters that are located within a precautionary zone that includes facilities that manufacture, use or store hazardous materials shall be provided with protection from hazardous materials releases as deemed necessary by the Local Emergency Planning Committee and the Authority Having Jurisdiction.~~

Chapter 7: Shelter Essential Features and Accessories

~~**702.4 First aid kit.** A first aid kit shall be supplied in all tornado shelters with a shelter occupant load of greater than 50.~~

~~**703.7 First aid kit.** A first aid kit shall be supplied in all community hurricane shelters.~~

Reason:
110: This language requires the Owner to submit a written statement of responsibility analogous to the Contractor's statement because there are many tasks which the Owner and the Owner alone have significant influence over that could cause a storm shelter to malfunction and not protect any of the occupants or even worse cause them injury or even death if they do not clearly understand and accept their responsibilities.

Section 202 definition of Local Emergency Planning Committee: The definition of a Local Emergency Planning Committee is not appropriate for a minimum standard because it does not refer to a specific group of people. For example, it is not established who determines which group of citizens constitute the Local Emergency Planning Committee. The term only appears in the ICC 500- 2014 code language one time, in Section 402.1, regarding siting adjacent to hazardous materials but it provides no additional level of protection. If there exists a Local Emergency Planning Committee which has jurisdiction over such matters such as proximity to hazardous materials, that jurisdiction exists already and it is not granted by the ICC 500 Standard. If there is not such an entity, the mandatory requirement for such a group to exist solely for this purpose creates a dilemma for Owners, Design Professionals and Building Officials in determining which group should be considered the Local Emergency Planning Committee. Some Design Professionals are simply ignoring this provision because it does not appear to be applicable when there are County and State groups that are called Local Emergency Planning Committees who do not want the responsibility of determining if all storm shelters have sufficient protection from hazardous materials if they are in such a precautionary zone because they are volunteer groups and such tasks are beyond the scope that they were created to fulfil. This is particularly problematic for Schools which are sometimes governed by a different tax boundary than the municipalities that overlap school district boundaries, creating further confusion when one school system has to manage shelters differently for different municipalities which have different interpretations of unclear provision like this. Good emergency plans can increase the cost of construction and/or operation and so they are not appropriate for a mandatory standard unless their requirements are clear, especially considering that non-employer and non-owner entities such as the Authority Having Jurisdiction can always make things "more safe" at more expense when they have no responsibility to pay for or operate the storm shelter.

There are many vitally important emergency planning tasks that need to take place for a storm shelter to successfully protect people. For example, if a storm shelter is locked and occupants from the host building cannot enter the shelter, the shelter will not protect the occupants. The Authority Having Jurisdiction has the duty and obligation to interpret and enforce the building code. However, for storm shelters that are not owned and operated by the Authority Having Jurisdiction, the unique responsibilities applicable to each individual storm shelter for on-site emergency planning, periodic on-site training of staff, periodic on-site maintenance of essential features and critical support systems, periodic drills with occupants, and on-site operations during an actual emergency belong, by necessity, to the individuals or group of individuals which are responsible for the activities that take place during the normal occupancy of the building, and this cannot be the responsibility of the Authority Having Jurisdiction or a separate Local Emergency Planning Committee because the people responsible and the nature of use for every building with a storm shelter will change with time. This is particularly true for Group E occupancy facilities, where the school system legally operates in loco parentis ("in the place of a parent") and that responsibility exists without a

definition in ICC 500 for a Local Emergency Planning Committee; in fact, the definition of this term in ICC 500-2014 could actually contradict this legally established responsibility unless the Local Emergency Planning Committee is the same entity as the school system (e.g. a School Board of citizens elected by the community to be responsible for the entire school system). Similarly, Section 5 "Duties" of the Occupational Safety & Health Act of 1970 (Public Law 91-596, 84 STAT. 1590, 91st Congress, S.2193, December 29, 1970, as amended through January 1, 2004) requires each employer, "shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees". By the creation of a storm shelter, there is the recognition that the applicable type of event for the type of shelter (tornado, hurricane or combined hurricane/tornado) is a recognized hazard which requires that Employers bear the responsibility for the above-mentioned on-site tasks which will be unique to each individual storm shelter. The proposed revision addresses these problems.

Section 402.1 regarding hazardous materials. This provision does not define what a "precautionary zone" is and is therefore not suitable for a minimum standard. Furthermore, the IBC now requires certain facilities such as Group E occupancies have tornado shelters; the unlimited authority of this provision could be applied by well-meaning authorities having jurisdiction that simply have no standard to rely on in interpreting this provision so they could prohibit construction of storm shelters on sites owned by school systems for decades in some instances, which effectively prohibits the school systems from constructing a school, whereas the risks of these hazards are often already required to be sufficiently addressed by states for schools to operate normally. The intent of this provision was to require a responsible party to consider the risks of hazardous materials and provide appropriate methods to address those risks. The only party that can effectively control these items during occupancy is the owner. It is nearly impossible to address the politics of this issue and this requirement could slow or stop the construction of a shelter trying to tackle this, which should be a case-by-case basis beyond the scope of this standard. The proposed revision addresses these problems.

Chapter 7 provisions regarding first aid kits. This provision does not define what are the required items in a first aid kit for a storm shelter and is therefore not suitable for a minimum standard. In addition, the only party that can effectively maintain any kind of first aid kit during occupancy is the owner. Furthermore, the IBC now requires certain facilities such as Group E occupancies and first response centers have tornado shelters; these organizations commonly have emergency operations plans that account for medical needs of their personnel in a manner that is inconsistent with a first aid kit in a storm shelter. For example, school systems often require that their teachers have "go bags" with emergency supplies when they go to designated areas during a storm, which they can bring into the storm shelters. A high school storm shelter in Texas can have several thousand students; a first aid kit does not sufficiently address all of the medical needs that a student population of that size will have, needs which school systems are completely familiar with because they manage them every day for their student population. This is an emergency planning and operational issue beyond the scope of this standard and current language should be deleted. The proposed revision addresses these problems.

Staff note: See IS-STM 01-21-2018 and 10-02-18 for changes to local emergency planning committee. Local Emergency Planning Committee is used in ICC 500 in Section 402.1.

Committee Action: As modified (9-0)

Replace with the following:

SECTION 107
~~CONSTRUCTION~~ SUBMITTAL DOCUMENTS

107.1 General. Where required by the authority having jurisdiction, ~~construction~~ submittal documents shall be prepared. Such documents shall contain information as required by the applicable building code and this section.

SECTION 108
QUALITY ASSURANCE PLAN

~~107.3~~ **108.1 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~~ 108.2 through 108.4.

~~107.3.1~~ **108.2 Detailed requirements.** A quality assurance plan shall be provided for the following:

1. Roof cladding, soffits 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. Wall cladding and wall cladding connections.
8. Corrosion resistance or protection of exposed metal connectors providing load path continuity.
9. Critical support systems and connections and debris impact protection of the components and connections.
10. Foundation design.
11. Prefabricated shelter installation requirements, including anchor location and minimum required capacity for each type of anchor.
12. Prefabricated shelter minimum foundation capacity requirements.

~~107.3.2~~ **108.3 Quality assurance plan preparation.** A quality assurance plan prepared by a registered design professional shall be provided for each main wind force-resisting system and each wind-resisting component.

The quality assurance plan shall identify the following:

1. The main wind force-resisting systems and wind-resisting components.
2. The special inspections and testing to be required in accordance with Section 106.2.
3. The type and frequency of testing required.
4. The type and frequency of special inspections required.
5. The structural observations to be performed in accordance with Section 106.4.
6. The required distribution, type and frequency of reports of test, inspections and structural observations.

~~107.3.3~~ **108.4 Contractor's statement of responsibility.** Each contractor responsible for the construction, fabrication or installation 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 the 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 compliance 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: A written statement of responsibility shall not be required for the ~~F~~abrication of storm shelter components that have been inspected and labeled by an approved agency as meeting the requirements of the applicable building code and this standard.

SECTION 109
OWNER'S RESPONSIBILITY.

109.1 Owner's statement of responsibility. For each community shelter the owner shall submit to the authority having jurisdiction a written statement of responsibility acknowledging the owner's responsibilities regarding shelter operation and maintenance with the application for a construction permit.

109.2 Emergency operation plan. For each community shelter the owner shall submit to the authority having jurisdiction a written emergency operations plan for the storm shelter prior to approval of the certificate of occupancy.

Committee Reason: This proposal provides some reorganization of Chapter 1 for clarification. The owner's responsibility needs to be clarified. It is important to have the emergency operation plan, so there needs to be some leverage to have that completed. There are guidelines for emergency operation plans on-line with FEMA. Glen Overcash will provide some information for commentary.

IS-STM 01-21-18

		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**14**	**1**	**0**	**0**	**1**
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: Editorial – 108.1 and 108.2 "For each *community storm shelter* the owner…" (italicized and added "storm") and italicize AHJ. Also 108.2 should operation plan be plural? Emergency operations plan. And Italicize 2nd "storm shelter".

Revise as follows:

108.1 Owner's statement of responsibility. For each *community storm shelter* the owner shall submit to the *authority having jurisdiction* a written statement of responsibility acknowledging the owner's responsibilities regarding shelter operation and maintenance with the application for a construction permit.

108.2 Emergency operation plan. For each *community storm shelter* the owner shall submit to the *authority having jurisdiction* a written emergency ~~operations~~ operation plan for the *storm shelter* prior to approval of the certificate of occupancy.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Overcash PC:		**x**		

Your comment/reason:
Current draft of Appendix A refers to plan as "Storm Shelter Emergency Preparedness and Operations Plan". Intent of this public comment is to correlate new Section 108.2 requirement with content proposed in Appendix A. Even if the Appendix A Working Group or Main Committee opts for different name (e.g., Storm Shelter Operations and Maintenance Plan), it would be helpful for the requirement and appendix to be directly linked.

Revise as follows:

108.2 Preparedness and emergency operations plan. For each community shelter the owner shall submit to the authority having jurisdiction a written preparedness and emergency operations plan for the storm shelter prior to approval of the certificate of occupancy.

IS-STM 01-22-18
ICC 500 Section 108.1

Proponent: Benchmark Harris, The National Storm Shelter Association (NSSA) Design Practices Committee

Revise as follows:
SECTION 108
DESIGN INFORMATION SIGNAGE AND LABELING

108.1 Design information. All shelters shall have a sign on or within the shelter with the name of the manufacturer or builder of the shelter and the storm type(s) and respective design wind speed(s). The sign shall remain legible and visible. If the shelter is a tornado shelter, the sign shall display the design capacity of the tornado shelter. If the shelter is a hurricane shelter, the sign shall display the design capacity of the hurricane shelter. If the shelter is a combined hurricane/tornado shelter, the sign shall display the different design capacities for the tornado shelter and the hurricane shelter cases.

Reason: With the introduction of the 2018 IBC provisions in Section 423 that require shelters accommodate existing school buildings and that building officials can reduce the design occupant load for school shelters if there are existing school shelters, it is important that the signs display the design capacity for the applicable shelter cases to avoid confusion in which Building Officials will not know how many people a shelter is design for. Determining the design capacity of a shelter after it has been built is not easy as calculating the usable floor plan area because the ventilation system and/or even the number of sanitation facilities may have been designed for less people than could have been accounted by floor plan area.

Staff Note: Modifications were also submitted for Commentary Figure 504.1.1 and 504.1.2

Add “Tornado Shelter Design Capacity: 1,500” to Figure 504.1.1.
Add “Tornado Shelter Design Capacity: 2,500” and “Hurricane Shelter Design Capacity: 1,500: to the top sign in Figure 504.1.2.
Add “Tornado Shelter Design Capacity: 400” to the middle sign in Figure 504.1.2.
Add “Hurricane Shelter Design Capacity: 2,000” to the bottom sign in Figure 504.1.2.

Figure 504.1.1

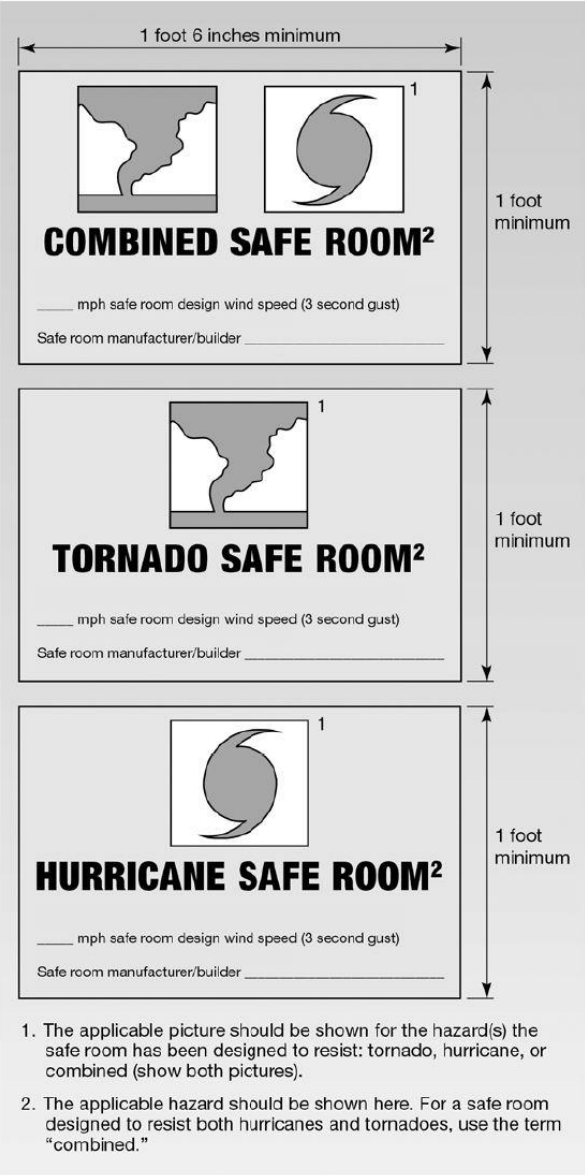


Figure 504.1.2

Committee Action: As modified (7-0 meeting) (12-0 electronic vote)

Replace with the following:

~~108.1~~ 504.2 Design information. All *storm shelters* shall have a sign on or within the *storm shelter* with all of the following:

1. The *storm shelter occupant load*
2. The storm type~~(s) and respective~~
3. The *storm shelter design wind speed*~~(s).~~
4. The edition of the ICC 500 used for the design
5. The name of the manufacturer or builder of the shelter ~~and~~

~~The sign shall remain legible and visible. If the shelter is a tornado shelter, the sign shall display the design capacity of the tornado shelter.~~

Committee Reason:

This would be consistent with what the committee already did with IS-STM 05-09-18 AM. The additions are making this a list and adding items 4 and 5. In item 3 the change is to use the defined term "storm shelter design wind speed".

The addition of requirements for storm shelter occupant load will help the code officials separate normal room capacity from shelter capacity. The edition of the standard will help for repairs and maintenance over time.

Reorder list for priority.

Make sure commentary revised sign diagrams.

Suggested to Work Group 5 to see if "storm shelter occupant load" to "storm shelter design capacity" so that people will not think this is a maximum permitted occupant load.

If you have a combined shelter, both occupant loads should be listed – good item for commentary language.

IS-STM 01-22-18

IS-STM 01-22-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	15	0	0	0	1
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Harris PC:		x		

Your comment/reason:
The term in the modified language of 508.2, item 1 is undefined and is not consistent with a newly defined term in the proposed standard that is the appropriate term to be used in this instance.

Proponent requests further modification of IS-STM 01-22-18 as follows:

508.2 Design information. All *storm shelters* shall have a sign on or within the *storm shelter* with all of the following:

1. The *storm shelter* ~~*occupant load*~~ *design occupant capacity*.
2. The storm type.
3. The *storm shelter design wind speed*.
4. The edition of the ICC 500 used for the design.
5. The name of the manufacturer or builder of the *storm shelter*.

IS-STM 01-25-18
ICC 500 Section 108.2.1(New)

Proponent: John Roberts, UL LLC

Revise as follows:

108.2.1 Marking. The following information shall be provided on each impact protective system:

1. Type of product tested, such as door, window or louver.
2. Date or edition of the testing standard utilized.
3. Missile size and velocity utilized.
4. Product or assembly design pressure and test pressure.

Reason:

- As a certification body, UL has been asked to assist in providing clarity on this topic.
- Improves the standard for market consistency of labeling, and will provide consistency for AHJ's when determining performance of products and the criteria as specified within Section 305.1.1 of this standard.

Below is an example door label for a product that has been tested to safe room criteria.

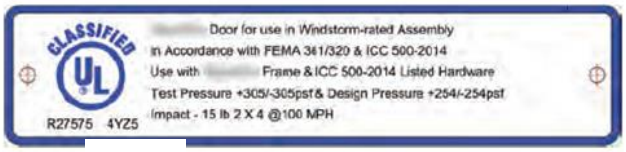


Figure B1-7. Example door label for a product that has been tested to safe room criteria

Staff note: Section 804.9 addresses many elements that need to be tested for impact. Doors, windows and shutters/other impact protective systems are addressed in separate sections. Is this intent to require this label on all systems, or just items such as doors, window or shutters? While this is a subsection of labeling, the literal language just says this information has to be provided, not that the produce has to have a permanent label on it with this information.

Committee Action: As Modified (9-0)

Replace with the following:

SECTION 108
~~DESIGN INFORMATION SIGNAGE AND~~ LISTING AND LABELING

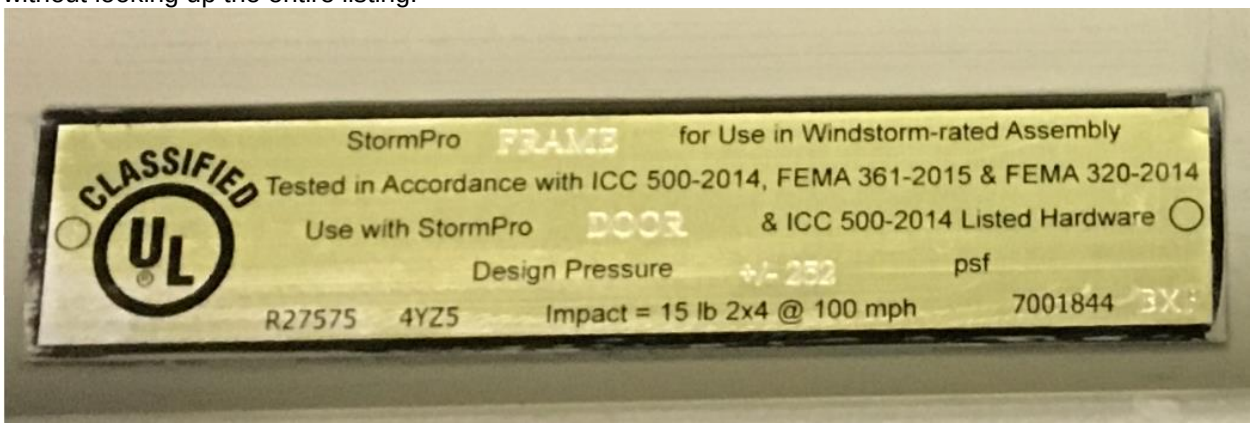
108.2 Listing and labeling. Impact-protective systems shall be listed and labeled denoting compliance with this standard. ~~Other than impact protective systems, products, materials or systems shall be labeled by an approved agency when required by the applicable code or jurisdiction.~~

108.2.1 Marking. The following function and performance characteristics shall be provided on the *label* for each *impact protective system* tested:

1. Manufacturer's identification reference or listing number for the assembly
2. Type of *impact protective system,* such as window assembly, door assembly, shutter assembly or louver.

3. Hazard: hurricane, tornado or both.
4. Missile weight and speed.
5. *Design wind pressure*.
6. Edition of ICC 500.

Committee Reason: Section 108 is renamed because this section is now listing and labeling and signage was moved to Chapter 5 by IS-STM 05-09-18. Section 108.2 should include listing as well as labeling provisions for impact protective systems. The last sentence is not needed since this is just a reference back to IBC requirements. Section 108.2.1 - The purpose of the label is to allow for the contractor, designer or inspector to quickly check if the correct product is installed in the correct place without looking up the entire listing.



IS-STM 01-25-18

IS-STM 01-25-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	**13**	**2**	**0**	**0**	**0**
Staff Notes: Scott's vote is editorial					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Schultz Vote:		**x**		

Your comment/reason: Where off the shelter products are not available which requires custom, engineered solutions, does this provision imply that these systems would need to be listed and labeled?

No revisions suggested:

112.1 Listing and labeling. *Impact-protective systems* shall be *listed* and *labeled* denoting compliance with this standard.

112.1.1 Marking. The following function and performance characteristics shall be provided on the *label* for each *impact protective system* tested:

7. Manufacturer's identification reference or listing number for the assembly.
8. Type of *impact protective system,* such as window assembly, door assembly, shutter assembly or louver.
9. Hazard: hurricane, tornado or both.
10. Missile weight and speed.
11. *Design wind pressure*.

12. Edition of ICC 500.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: Editorial – Section 112.1, italicize “impact-protective systems”, “listed’ and “labeled”, Section 112.1.1, period at end of #1

Revise as follows:

112.1 Listing and labeling. *Impact-protective systems* shall be *listed* and *labeled* denoting compliance with this standard.

112.1.1 Marking. The following function and performance characteristics shall be provided on the *label* for each *impact protective system* tested:

1. Manufacturer’s identification reference or listing number for the assembly.
2. Type of *impact protective system,* such as window assembly, door assembly, shutter assembly or louver.
3. Hazard: hurricane, tornado or both.
4. Missile weight and speed.
5. *Design wind pressure*.
6. Edition of ICC 500.

IS-STM 01-27-18
ICC 500 Section 106, 107

Proponent: ICC 500 Work Group 1:

SECTION ~~107~~ 106
CONSTRUCTION DOCUMENTS
(Renumber all of existing Section 107)

SECTION 107
PEER REVIEW
107.1 ~~106.1.1~~ Peer review.
107.2 ~~106.1.2~~ Peer review report.

SECTION ~~106~~ 108
SPECIAL INSPECTIONS ~~AND STRUCTURAL OBSERVATIONS~~

~~**106.1 General.** Construction of storm shelters and installation of all equipment shall be subject to inspections in accordance with the applicable building code.~~
108.1 ~~106.2~~ Special inspections.
108.1.1 ~~106.2.1~~ Inspection of fabricators.
108.2 ~~106.3~~ Special cases.
108.2.1 ~~106.3.1~~ Special inspections to verify anchor installation.

SECTION 109
STRUCTURAL OBSERVATIONS
109.1 ~~106.4~~ Structural observations.

Reason: Split up requirements in Section 106 for clarity. Put after construction documents since this information is part of the construction documents or happens during construction.

Committee Action: As Submitted (11-0)

Committee Reason: Split up requirements in Section 106 for clarity. Put after construction documents since this information is part of the construction documents or happens during construction.

IS-STM 01-27-18

IS-STM 01-27-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	13	2	0	0	0
Staff Notes: Manley comment is errata					

		Committee action: As Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		
Your comment/reason: As written it is not clear if Section 106.2.5 is talking about additional building				

department inspections or special inspections. It would seem to be the latter, as CD's do not typically list building department inspections but do typically include a list of special inspections, if not the entire statement of special inspections. Further, IS-STM 01-20-18 deleted the word "special" from 106.2.6 as it relates to details, instructions or latching/locking of doors or windows. Suggest revising 106.2.4 and 106.2.5 to replace the reference to "special" details with references to "unusual or alternative" systems or details, consistent with the cases listed that require special inspections (existing 106.3 / new 110.1.2):

Revise as follows:

106.2.4 Special Inspections. Where any unusual or alternative ~~special~~ details, materials or systems are utilized in the design of the structure, or where any special inspections ~~investigations~~ are required in addition to those required by the *applicable code*, the construction documents shall contain a schedule of the special inspections required and the criteria for ~~the special~~ installation.

106.2.5 Unusual or alternative ~~Special~~ details. The construction documents shall provide or include any ~~special~~ manufacturer's details or installation instructions for unusual or alternative systems or equipment designed for the storm shelter.

		Committee action: As Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:		**x**		

Your comment/reason: In the new Section 110.1.2.1 (Clean Draft), the existing reference to Section 107.2.1 appears incorrect.

Revise as follows:

110.1.2.1 *Special inspections* to verify anchor installation. A *special inspection* shall be provided to verify the post-installed anchor installation and capacity in accordance with Section ~~107.2.1~~ 106.2.1. For post-installed anchorage to foundations, *special inspection* shall be provided to verify foundation adequacy in accordance with Sections ~~107.2.1~~ 106.2.1 and 307.

Exception: For *residential storm shelters*, where the *authority having jurisdiction* verifies that the anchorage and, where required, the foundation complies with the requirements of the *storm shelter* design as provided in documentation required by Section 106, *special inspection* is permitted to be waived by the *authority having jurisdiction*.

IS-STM 01-28-18
ICC 500 Section 202, 106.1.1, 106.1.2, 107(New)

Proponent: ICC 500 Work Group 1:

PEER REVIEW. A review of the storm shelter ~~in accordance with Section 106.1.1~~ by ~~a~~ an independent registered design professional~~(s) independent from the registered design professional(s) in responsible charge of the storm shelter design. The peer review includes checking the construction documents, calculations and quality assurance plan for the storm shelter design.~~

SECTION 107
PEER REVIEW

~~**106.1.1 Peer review.** A peer review shall be conducted by an independent registered design professional for compliance with the requirements of Chapters 3, 5, 6 and 7 for the following storm shelter types:~~

1. ~~Community shelters with an occupant load greater than 50.~~
2. ~~Storm shelters in elementary schools, secondary schools and day care facilities with an occupant load greater than 16.~~
3. ~~Storm shelters in Risk Category IV (essential facilities) as defined in Table 1604.5 in the *International Building Code*.~~

107.1 Storm shelters requiring peer review. A peer review shall be conducted for the following storm shelter types:

1. Community shelters with an occupant load greater than 50.
2. Storm shelters in elementary schools, secondary schools and day care facilities with an occupant load greater than 16.
3. Storm shelters in Risk Category IV (essential facilities) as defined in Table 1604.5 in the *International Building Code*.

107.2 Peer review. The owner or the owner's authorized agent, other than the registered design professionals for the project, shall employ independent registered design professionals to conduct a peer review for compliance with the requirements of Chapters 3, 5, 6 and 7.

> **Exception:** Registered design professional for the project are permitted to employ the peer reviewer where the registered design professional for the project is also the owner.

107.3 Peer reviewer disclosure. The peer reviewer shall disclose to the *authority having jurisdiction* and the owner or the owner's authorized agent possible conflicts of interest, financial or otherwise.

107.4 Peer reviewer qualifications. The peer reviewers shall provide written documentation to the owner or owner's authorized agent, demonstrating relevant experience and training in the specific areas of practice being peer reviewed and similar in complexity to the type of storm shelter design under review.

~~**106.1.2**~~ **107.5** ~~**Peer review report.** Where a peer review is required by Section 106.1.1, a~~ A signed and sealed report shall be submitted to the authority having jurisdiction with the construction documents ~~identified in Section 107~~ prior to the issuance of a permit for

construction. The report shall describe the items reviewed, provide an explanation of non-compliant issues, and recommend acceptance or rejection of the items reviewed ~~their compliance or noncompliance with applicable codes and standards, and recommend acceptance or rejection of the storm shelter design or modifications to render the design acceptable~~.

> **107.5.1 Changes**. The registered design professional in responsible charge shall submit to the peer reviewer any changes to the design that occur after the initial peer review report and are related to the requirements of Section 107.1. If determined to be needed by the peer reviewer, an amended peer review report shall be submitted to the AHJ before such design changes are implemented.
>
> **107.5.2 Deferred submittal.** A peer review shall be required for deferred submittals that are related to the requirements of Section 107.1

Reason: This proposal reorganizes and clarifies the requirements for peer review for certain critical shelter types. The requirements for the peer review report are revised to better capture how the peer reviewers detail their findings in their reports and recommend acceptance or rejection of the submitted shelter design. New language addresses how proposed changes to the shelter design during the construction process and deferred submittals are handled. New language modeled on IBC Chapter 17 requirements for independence and qualifications of peer reviewers is introduced.

This new comprehensive proposal replaces IS-STM 01-04, 01-05, 01-06, 01-08, 01-09, 01-10, 02-03, 02-06 and 02-07.

Committee Action: As modified (11-0 mod), (11-0 proposal)

Further modify:

107.2 Peer review. The owner or the owner's authorized agent, other than the registered design professionals for the project, shall employ independent registered design professionals to conduct a peer review for compliance with the requirements of Chapters 3, 5, 6 and 7.

> **Exception:** A registered design professional for the project ~~are~~ is permitted to employ the peer reviewer where the registered design professional for the project is also the owner.

107.3 Peer review disclosure. The peer reviewer shall disclose to the owner or the owner's authorized agent and to the *authority having jurisdiction* any possible conflicts of interest, financial or otherwise.

107.5 Peer review report. A signed and sealed report shall be submitted to the owner or owner's authorized agent and to the authority having jurisdiction with the construction documents prior to the issuance of a permit for construction. The report shall describe the items reviewed, provide an explanation of non-compliant issues, and recommend acceptance or rejection of the items reviewed.

Committee Reason: Modifications are for consistency of language, and owner gets all the relevant information. Proposal is general cleanup of language and requirements for peer review, including clarifying peer reviewer independence, qualifications and how submittals are treated.

IS-STM 01-28-18

IS-STM 01-28-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	11	3	1	0	2

Staff Notes: These comments to 109.3 and 109.5.1 are errata

109.3 Peer reviewer disclosure. The peer reviewer shall disclose ~~to the owner or the owner's authorized agent and~~ to the authority having jurisdiction and the owner or the owner's authorized agent any possible conflicts of interest, financial or otherwise.

109.5.1 Changes. The registered design professional in responsible charge shall submit to the peer reviewer any changes to the design that occur after the initial peer review report and are related to the requirements of Section ~~107.1~~ 109.1. If determined to be needed by the peer reviewer, an amended peer review report shall be submitted to the AHJ before such design changes are implemented.

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		

Your comment/reason: Editorial cleanup to remove redundant language and fix awkward phrasing:

Revise as follows:

109.1 Storm shelters requiring *peer review*. A *peer review* shall be conducted for the following *storm shelter* types:
1. *Community storm shelter*s with *a storm shelter design occupant capacity* of 50 or greater.
2. *Storm shelters* in elementary schools, secondary schools and day care facilities with *a storm shelter design occupant capacity* greater than 16.
3. *Storm shelters* for buildings and structures assigned to ~~in~~ Risk Category IV (essential facilities) as defined in Table 1604.5 in the *International Building Code.*

109.2 Peer review. The owner or the owner's authorized agent, other than the registered design professionals for the project, shall employ independent registered design professionals to conduct a peer review for compliance with the requirements of Chapters 3, 5, 6 and 7.

> **Exception:** A registered design professional for the project is ~~are~~ permitted to employ the peer reviewer where the registered design professional for the project is also the owner.

109.3 Peer reviewer disclosure. The peer reviewer shall disclose ~~to the owner or the owner's authorized agent and~~ to the authority having jurisdiction and the owner or the owner's authorized agent any possible conflicts of interest, financial or otherwise.

109.4 Peer reviewer qualifications. The peer reviewers shall provide written documentation to the owner or owner's authorized agent, demonstrating relevant experience and training in the specific areas of practice being peer reviewed and for projects similar in complexity to the type of storm shelter design under review.

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:		x		
Your comment/reason:				

a. Do we need an 'of' in 109.1 item 1, as shown below?
b. In 109.2 exception – grammar problem
c. In 109.3, duplicate text needs to be deleted, such as below (or could eliminate the first occurrence)
d. In 109.4, delete an unnecessary comma
e. in 109.5.1, the text references section 107.1. Should the text be calling out Section 109.1 here?
f. definition of Peer Review in Chapter 2 – need to insert word 'design'

Revise as follows:

109.1 Storm shelters requiring *peer review*. A *peer review* shall be conducted for the following *storm shelter* types:
1. *Community storm shelter*s with *a storm shelter design occupant capacity* of 50 or greater.
2. *Storm shelters* in elementary schools, secondary schools and day care facilities with *a storm shelter design occupant capacity* greater than 16.
3. *Storm shelters* in Risk Category IV (essential facilities) as defined in Table 1604.5 in the *International Building Code.*

109.2 Peer review. The owner or the owner's authorized agent, other than the registered design professionals for the project, shall employ independent registered design professionals to conduct a peer review for compliance with the requirements of Chapters 3, 5, 6 and 7.

> **Exception:** A registered design professional for the project is ~~are~~ permitted to employ the peer reviewer where the registered design professional for the project is also the owner.

109.3 Peer reviewer disclosure. The peer reviewer shall disclose ~~to the owner or the owner's authorized agent and~~ to the authority having jurisdiction and the owner or the owner's authorized agent any possible conflicts of interest, financial or otherwise.

109.4 Peer reviewer qualifications. The peer reviewers shall provide written documentation to the owner or owner's authorized agent~~,~~ demonstrating relevant experience and training in the specific areas of practice being peer reviewed and similar in complexity to the type of storm shelter design under review.

109.5 Peer review report. A signed and sealed report shall be submitted to the owner or owner's authorized agent and to the *authority having jurisdiction* with the construction documents prior to the issuance of a permit for construction. The report shall describe the items reviewed, provide an explanation of non-compliant issues, and recommend acceptance or rejection of the items reviewed.

> **109.5.1 Changes**. The registered design professional in responsible charge shall submit to the peer reviewer any changes to the design that occur after the initial peer review report and are related to the requirements of Section ~~107.1~~ 109.1. If determined to be needed by the peer reviewer, an amended peer review report shall be submitted to the AHJ before such design changes are implemented.
>
> **109.5.2 Deferred submittal.** A *peer review* shall be required for deferred submittals that are related to the requirements of Section 109.1.

PEER REVIEW. A review of the *storm shelter* design by an independent registered design professional.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**

Manley Vote:		**x**		

Your comment/reason: In the exception to Section 109.2 (Clean Draft), modify to read "A registered design professional for the project **is** permitted…" Also, in Section 109.5.1 (Clean Draft), the section needs to be corrected from Section 107.1 to Section 109.1.

Revise as follows:

109.2 Peer review. The owner or the owner's authorized agent, other than the registered design professionals for the project, shall employ independent registered design professionals to conduct a peer review for compliance with the requirements of Chapters 3, 5, 6 and 7.

Exception: A registered design professional for the project is ~~are~~ permitted to employ the peer reviewer where the registered design professional for the project is also the owner.

109.5.1 Changes. The registered design professional in responsible charge shall submit to the peer reviewer any changes to the design that occur after the initial peer review report and are related to the requirements of Section ~~107.1~~ 109.1. If determined to be needed by the peer reviewer, an amended peer review report shall be submitted to the AHJ before such design changes are implemented.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:			**x**	

Your comment/reason: 109.2-Peer review should also include chapters 1 and 4.

Chapter 1- The peer review consists of reviewing the construction documents. Chapter 1 has requirements for information to be included in the construction documents being reviewed including the information in 106.2.1 thru 106.2.2, and sections 107, 110 and 111. The peer review should include verifying this information has been provided.

Chapter 4-This chapter has requirements for the storm shelter to be located out of specified flood area and now has requirements for maximum travel distance. This information should be peer reviewed for conformance.

Revise as follows:

109.2 Peer review. The owner or the owner's authorized agent, other than the registered design professionals for the project, shall employ independent registered design professionals to conduct a peer review for compliance with the requirements of Chapters 1, 3, 4, 5, 6 and 7.
Exception: A registered design professional for the project are permitted to employ the peer reviewer where the registered design professional for the project is also the owner.

109.3-Remove "and the owner or the owner's authorized agent" after "authority having jurisdiction". This appears to be redundant.

Revise as follows:

109.3 Peer reviewer disclosure. The peer reviewer shall disclose ~~to the owner or the owner's authorized agent and~~ to the authority having jurisdiction and the owner or the owner's authorized agent any possible conflicts of interest, financial or otherwise.

109.5.1-This requirement can and will cause issues relative to project schedules and can result in contractor claims against the peer reviewer for untimely reviews that are out of the control of the peer reviewer. Field revisions can sometimes be on the fly. This requirement will require any and all peer reviewers to be in an "on-call" status during the construction process which could be much later i.e. over

a year from the time of the initial peer review. If the peer reviewer is not available to review "on the fly changes", the field change is made without the review then in the opinion of the peer reviewer the change does not comply with the standard, this may result in a contract's claim against the owner/design team/peer reviewer due to the need to replace installed work. This provision will drive up the cost of the peer review. **Recommend deleting this provision in its entirety.**

Delete without substitution:

~~**109.5.1 Changes**. The registered design professional in responsible charge shall submit to the peer reviewer any changes to the design that occur after the initial peer review report and are related to the requirements of Section 109.1. If determined to be needed by the peer reviewer, an amended peer review report shall be submitted to the AHJ before such design changes are implemented.~~

109.5.2-It is unclear as to what the peer reviewer will review on the deferred submittals. Design teams are going to expect the peer reviewer to review them similar to a shop drawing but this is not the role of the peer reviewer. At this point, the peer reviewer has completed the intent of the peer review provision and that is to assure the design meets the intent of the code standard. The structural loads to be utilized have already been reviewed. Wouldn't it be the responsibility of the design team to verify that the deferred submittal meets the requirements of the peer reviewed design and therefore would be the peer review for that submittal? This provision will drive up the cost of the peer review. **Recommend deleting this provision in its entirety.**

Delete without substitution:

~~**109.5.2 Deferred submittal.** A *peer review* shall be required for deferred submittals that are related to the requirements of Section 109.1.~~

Section 202- The definition of Peer Review should read "A review of the storm shelter design…"
As defined, it implies that the peer review could include a review of the final constructed shelter.

Revise as follows:

PEER REVIEW. A review of the *storm shelter* design by an independent registered design professional.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Larry Curtis PC		**x**		

Your comment/reason:
1. Even though the peer reviewer may be making an amended report, the AHJ is the final authority allowing such change to be implemented.

Revise as follows:

109.5.1 Changes. The registered design professional in responsible charge shall submit to the peer reviewer any changes to the design that occur after the initial peer review report and are related to the requirements of section 107.1. If determined to be needed by the peer reviewer, an amended peer review report shall be submitted to the AHJ and subsequently be approved before such design changes are implemented.

2. A peer reviewer is not in responsible charge of final design or construction administration of a project

once the peer review report has been submitted to the AHJ. Based on the peer review process, the design professional in responsible charge is equipped to perform these reviews and if necessary can reach out to the peer reviewer if specific questions arise. Additionally, the design professional in responsible charge is not privy to the schedule and may not be able to accommodate a review on short notice which can create unintended consequences on a project such as schedule delays.

Delete without substitution:

~~**109.5.2 Deferred Submittal.** A *peer review* shall be required for deferred submittals that are related to the requirements of Section 109.1.~~

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason:
Transcribing error – repeated phrase

Revise as follows:

109.3 Peer reviewer disclosure. The peer reviewer shall disclose ~~to the owner or the owner's authorized agent and~~ to the *authority having jurisdiction* and the owner or the owner's authorized agent any possible conflicts of interest, financial or otherwise.

Chapter 2
DEFINITIONS

IS-STM 02-01-18
ICC 500 Section 202(New)

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests or furnishing inspection services, where such agency meets all applicable criteria and has been approved by the building official.

Reason: Previously, it was not clear which entities or organizations would be considered an "approved agency". The proposed definition, taken from the 2015 IBC, provides correlation with the code and serves to clarify the intent of requirements found in Sections 106.2.1, 107.3.3 and 108 which invoke the term "approved agency". The term is also referenced in 2014 ICC 500 definitions of *Special Inspector* and *Labeled*.

Staff note: Approved agency is used in ICC 500 in Section 106.2.1, 107.3.3, 108.2, 202 (Label, labeled, special inspector).
The 2018 IBC has revised the definition:

> **[A] APPROVED AGENCY.** An established and recognized agency that is regularly engaged in conducting tests or furnishing inspection services or furnishing product certification where such agency has been *approved* by the *building official*.

Committee Action: As Modified (6-0 meeting) (12-0 electronic vote)

Modify proposal as follows:

APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, ~~or~~ furnishing inspection services or furnishing product certification, where such agency ~~meets all applicable criteria and~~ has been approved by the building official.

Committee Reason: Revisions is to match with the 2021 IBC definition. This term is used in Section 106.2.1, 107.3.3, 108.2, 202 (Label, labeled, special inspector).

IS-STM 02-01-18

IS-STM 02-01-18		Committee action: Approval as Modified			
	Affirmative	Affirmative	Negative with	Abstain with	Public

		with comment	comment	reason	Comment
Report	**14**	**1**	**0**	**0**	**0**
Staff Notes: Assigned to work group 1					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:		**x**		

Your comment/reason: The definition of “approved agency” makes reference to “building official”, which is not used in the standard. Change to “authority having jurisdiction”.

Revise as follows:

APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification, where such agency has been approved by the ~~building official~~ authority having jurisdiction.

IS-STM 02-08-18
ICC 500 Section 202

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

SHELTER ENVELOPE. The protective walls, roofs, doors, and other ~~protected~~ openings~~s~~ systems that are designed and tested to meet the requirements of Chapter 3 to provide protection to occupants during a severe windstorm.

Reason: The revision to "shelter envelope" definition clarifies that the impact protective system that covers the opening, and not the opening itself, comprises a portion of the storm shelter envelope. Additionally, the revision clarifies that shelter envelope systems must meet both the design and testing criteria established in Chapter 3 of the standard.

Staff note: Shelter envelope is used in ICC 500 in Section 107.2.1, 107.3.1, 202 (design wind pressure, interior surface of the shelter component), 305.1.1, 305.1.2, 305.2, 305.2.1, 306.1, 306.3, 306.3.1, 306.7, 306.8, 309, 309.1, 602.2, 801.1, 804.10.1,.

Committee Action: As Modified (9-0)
Reconsideration for editorial correction (11-0) with electronic vote

Replace with the following:

SHELTER ENVELOPE. The ~~protective~~ impact and pressure resistant roofs, walls and floors and the acc systems that ~~doors and other protected openings that are designed to meet the requirements of Chapter 3 to~~ provide protection to occupants during a severe windstorm and meet the requirements of Chapter 3.

IMPACT-PROTECTIVE SYSTEM. A system or device ~~such as a shutter, door or other device mounted on the inside or outside of the exterior wall of a shelter that has been demonstrated by testing to be~~ installed to protect an opening in a roof, wall or floor of the shelter envelope that is capable of withstanding pressure and ~~the~~ impact ~~of test missiles~~ testing as detailed in this standard.

4-25-2019 Reconsideration –

IMPACT-PROTECTIVE SYSTEM. A system or device, subject to pressure and impact testing as detailed in this standard, installed to protect an opening in a roof, wall or floor of the shelter envelope ~~that is capable of withstanding pressure and impact testing as detailed in this standard~~.

Committee Reason: The terms in the text are not always used consistently. If we define the terms better, this can be matched in the text. The modifications to shelter envelope clarifies which pieces make up the shelter envelope. This provides a clear place to stop the calculations/construction requirements.

Regarding the modification to impact protective systems – the lowest exposed floor of an elevated storm shelter would have to be designed for pressure testing. The shutters do not need to be specifically called out anymore, since it is a type of impact-protective system.

Reconsideration reason: As it is currently written, the phrase "subject to pressure and impact testing as detailed in this standard" is applicable to the roof, wall or floor, not the system or device.

IS-STM 02-08-18

IS-STM 02-08-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	15	0	0	0	1
Staff Notes: Assigned to work group 3.					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Dain PC:		x		

Your comment/reason:
a. "a severe windstorm" is subjective, this standard is specifically for tornados and hurricanes, and this revision is in line with approved revisions to 101.2.

Revise as follows:

SHELTER ENVELOPE, STORM. The impact and pressure resistant roofs, walls and floors and the *impact-protective systems* that provide protection to occupants during ~~a severe windstorm~~ tornadoes and hurricanes and meet the requirements of Chapter 3.

b.Storm shelter envelope is defined and deleted the word protective - using protective in 'rebound impact' although true may suggest something else.

Revise as follows:

REBOUND IMPACT. The impact by a test missile, or fragments thereof, on a portion of the *storm shelter* ~~protective~~ envelope after the test missile has impacted another surface of the *storm shelter* ~~protective~~ envelope.

IS-STM 02-09-18
ICC 500 Section 202(New)

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

TEST LABORATORY. A testing agency certified in accordance with ISO/IEC 17025 to conduct missile impact and pressure testing required in Chapter 8.

TESTING AGENCY. See "Test Laboratory."

QUALIFIED LAB. See "Test Laboratory."

Reason: This definition clarifies which testing laboratories qualify for testing of storm shelters and components. This definition clarifies which testing laboratories are approved for testing of storm shelters and components by directing the reader to the "Test Laboratory" definition because both terms are used interchangeably in the ICC 500 standard.

Staff Note:

- Test laboratory is used in Section 803.4, 804.9.1, 804.9.2, 804.9.3, 804.9.4. Testing agency is used in Section 803.4. Qualified lab is used in Section 804.1, 805.1.
- These were submitted as three separate changes, but they have been combined since the do not include any different proposed text.
- A question would be if these terms all mean the same thing, why not use the same term?

Committee Action: As Modified (8-0)

Replace with the following:

TEST LABORATORY. A testing agency certified in accordance with ISO/IEC 17025 to conduct missile impact and pressure testing required in Chapter 8.

803.4 Specifications/drawings. The manufacturer or constructor shall provide the test laboratory with applicable product specifications and/or drawings detailing materials of construction and applicable installation details. The ~~testing agency~~ test laboratory shall verify conformance of the test specimen to the product specifications and/or drawings.

804.1 Apparatus. The general description of the apparatus for performing the missile impact testing requirements of this standard is detailed in Section 6 of ASTM E1886. Any equipment, properly certified, calibrated and approved by a ~~qualified lab~~ test laboratory capable of performing this test within the allowable tolerance is permitted.

Committee Reason: The committee agrees with the staff note to change 'Testing Agency' and 'Qualified Lab' to 'Test Laboratory' wherever the terms appear in the 2014 Edition

Also change to match in new text.

Staff note: "testing agency" has been added in the following. Should this also be revised?

(IS-STM 08-07-18 AM)
803.10.2 ~~804.10.2~~ Dislodgment and disengagement. *Specimen*s and load-bearing fasteners, where used, shall not become disengaged or dislodged during the test procedures so as to endanger occupants. Disengagement or dislodgement that occurs in a test shall be demonstrated to not endanger occupants ~~be harmless~~ by failing to perforate a #70 unbleached kraft paper witness screen. The ~~with its~~ surface of the witness screen shall be secured in place on a rigid frame installed ~~within~~ not more than 5 inches (127 mm) ~~of the interior surface of the shelter~~ from the innermost component deemed by the testing agency to be most susceptible to disengagement or dislodgement. The rigid frame shall maintain tautness of the kraft paper and shall have continuous supports in one direction at intervals no greater than 3 feet (914 mm).

(IS-STM 08-07-18 AM)
803.10.3 ~~804.10.3~~ Spall. Excessive spall shall not be released from the interior surface of any specimen during the test procedures so as to endanger occupants. Excessive spall is defined as that which perforates a #70 unbleached kraft paper witness screen ~~with its~~. The surface of the witness screen shall be secured in place on a rigid frame installed not more than 5 inches (127 mm) from the ~~interior~~ innermost surface of the test *specimen* deemed by the testing agency to be most susceptible to spalling. The ~~witness screen~~ rigid frame shall maintain tautness of the kraft paper and shall have continuous supports in one direction at intervals no greater than 3 feet (914 mm).

~~**Exception:** Where warnings are to be provided marking the protected occupant area beyond the 5-inch (127 mm) limit defined above, the witness screen is permitted to be positioned at the boundary of the protected area, and excessive spall defined as that which will perforate the witness screen in this position.~~

IS-STM 02-09-18

IS-STM 02-09-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	13	1	1	0	0
Staff Notes: Assigned to work group 8.					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Manley Vote:			x	

Your comment/reason: The proposed definition of "test laboratory" includes a requirement that the agency be certified in accordance with ISO/IEC 17025. I think this is inappropriate for a definition and, if deemed absolutely necessary, such a reference really should be in the main body of the standard. Interestingly, the IBC has steered clear of defining test laboratory and calling out a minimum certification standard. The IBC makes due with the defined term "Approved Agency". Couldn't that work here?

Revise as follows:

APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification, where such agency has been approved by the building official.

~~**TEST LABORATORY.** A testing agency certified in accordance with ISO/IEC 17025 to conduct missile impact and pressure testing required in Chapter 8.~~

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:		**x**		

Your comment/reason:
REBOUND IMPACT-For consistency with other definitions, remove the words "protective" and italicize "storm shelter envelope".

Revise as follows:

REBOUND IMPACT. The rebound impact by a test missile, or fragments thereof, on a portion of the *storm shelter* ~~protective~~ envelope after the test missile has impacted another surface of the *storm shelter* ~~protective~~ envelope.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason: coordination with defined term

804.1 **Apparatus.** The general description of the apparatus for performing the pressure testing requirements of this standard is detailed in Section 6 of ASTM E330 when performing the static pressure test, or ASTM E1886 when performing the cyclic test. Any equipment, properly certified, calibrated and approved by a ~~qualified lab~~ test laboratory, capable of performing this test, within the allowable tolerance, is permitted.

IS-STM 02-10-18
ICC 500 Section 202

Proponent: ICC 500

Revise as follows:

SECTION 202
DEFINITIONS

ALCOVE STORM **SHELTER ENTRY SYSTEM.** See the definition of "Entry System, Alcove or Baffled Storm Shelter."

APPLICABLE CODE. The regulation for design and building construction of buildings and structures adopted by the *authority having jurisdiction* over the construction of the specific *storm shelter*.

AREAS OF CONCENTRATED FURNISHINGS. The areas of a *storm shelter* with furniture or fixtures that cannot be moved easily, 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* with furniture or fixtures that can be moved easily, including areas such as classrooms and offices.

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

AUTHORITY HAVING JURISDICTION. The organization, political subdivision, office or individual charged with the responsibility for administering and enforcing the provisions of this standard.

BAFFLED STORM **SHELTER ENTRY SYSTEM.** See the definition of "Entry System, Alcove or Baffled Storm Shelter."

COLLAPSE HAZARDS. See "Hazards, Collapse."

CRITICAL SUPPORT SYSTEMS. Structures, systems and components required to ensure the health, safety and well-being of occupants. Critical support systems include, but are not limited to, potable and waste water systems, electrical power systems, life safety systems and HVAC systems.

DESIGN WIND PRESSURE. The wind pressure on a specific location of the *storm shelter envelope*, as determined in accordance with Section 304, Wind Loads, which controls the design of components and cladding (C & C) of the *storm shelter envelope* or the main wind-force resisting system (MWFRS) for the *storm shelter*.

~~**STORM SHELTER**~~ **DESIGN WIND SPEED, STORM SHELTER.** The maximum wind speed for which the *storm shelter* has been designed. Values shall be the nominal 3-second gust wind speed in miles per hour (km/h) at 33 feet (10 m) above ground for open terrain (Exposure C).

~~**SHELTER**~~ **ENTRY SYSTEM, ALCOVE OR BAFFLED** STORM **SHELTER.** An entry system that uses walls and passageways to allow access and egress to the *storm shelter* interior while providing shielding from wind-borne debris in accordance with Section 306.5.

~~**SHELTER ENTRY SYSTEM, BAFFLED** See the definition of "Shelter Entry System, Alcove."~~

FIRE BARRIER. A fire-resistance-rated ~~vertical~~ wall assembly of materials designed to restrict the spread of fire in which ~~openings are protected~~ continuity is maintained.

FURNISHINGS. See AREAS OF CONCENTRATED FURNISHINGS, AREAS OF UNCONCENTRATED FURNISHINGS and AREAS OF OPEN PLAN FURNISHINGS

HAZARDS.

Coastal. See definition for Coastal High-Hazard Area.

Collapse. Debris from wind damage to adjacent, taller structures that could fall onto the *storm shelter*.

Flood. See definition for Flood Hazard Area.

Laydown. Nearby structures such as towers or large trees that could fall onto the *storm shelter*, if the *storm shelter* is within the laydown radius of the structure.

Rollover. Vehicles and small buildings, such as temporary classroom buildings, that could roll over due to extreme winds and impact the *storm shelter*.

HORIZONTAL ASSEMBLY. A fire-resistance-rated floor or *roof assembly* of materials designed to restrict the spread of fire in which continuity is maintained.

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

HURRICANE SHELTER. See the definition for Storm Shelter.

IMPACT-PROTECTIVE SYSTEM. A system or device installed to protect an opening in a roof, wall or floor of the *storm shelter envelope* that is capable of withstanding pressure and impact testing as detailed in this standard.

~~**INTERIOR SURFACE OF THE SHELTER COMPONENT.** The inside surface of any structural component of the storm shelter envelope.~~

LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency.

LABELED. Equipment, materials or products to which has been affixed a *label*, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

LAYDOWN HAZARDS. See “Hazards, Laydown.”

LOCAL EMERGENCY PLANNING COMMITTEE. A group of citizens defined by the community as having responsibility for local emergency planning. The committee shall be recognized by the governing body as having this responsibility.

NATURAL VENTILATION. Passive ventilation, not requiring a power source, resulting from convection of heated air, movement of inside air and movement of outside air over and around the *storm shelter* resulting in air exchange through vent openings.

~~**STORM SHELTER**~~ **OCCUPANT LOAD, STORM SHELTER.** The occupant load intended for a room or space when that space is in use as a *storm shelter*.

OCCUPANT SUPPORT AREAS. The areas required to ensure the health, safety and well-being of occupants. *Occupant support areas* include, but are not limited to, *storm shelter* management, food preparation, water and food storage, electrical and mechanical rooms, toilet and other sanitation rooms and first-aid stations.

OCCUPIED STORM **SHELTER AREAS.** The designated *storm shelter* area.

ON-SITE. Either inside, immediately adjacent to, or on the same site as the designated *storm shelter* facility, and under the control of the owner or lawful tenant.

PEER REVIEW. A review of the *storm shelter* in accordance with Section 106.1.1 by a registered design professional(s) independent from the registered design professional(s) in responsible charge of the storm shelter design. The peer review includes checking the construction documents, calculations and quality assurance plan for the storm shelter design.

PROTECTED OCCUPANT AREA. The portions of the *storm shelter* area that are protected from intrusion of storm debris by *alcove or baffled storm shelter entry systems* in accordance with Section 804.9.7.

REBOUND IMPACT. The ~~rebound~~ impact by a test missile, or fragments thereof, on a portion of the *storm shelter* protective envelope after the test missile has impacted another surface of the *storm shelter* protective envelope.

ROLLOVER HAZARDS. See "Hazards, Rollover."

SHELTER ENVELOPE, STORM**.** The protective roofs, walls and floors doors and other protected openings that are designed to meet the requirements of Chapter 3 to provide protection to occupants during a severe windstorm.

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*.

STORM SHELTER. A building, structure or portion(s) thereof, constructed in accordance with this standard, designated for use during a severe wind storm event such as a hurricane or tornado.

Community Storm Shelter. Any *storm shelter* not defined as a *residential storm shelter*.

Residential Storm Shelter. A *storm shelter* serving occupants of dwelling units and having ~~an~~ *a storm shelter occupant load* not exceeding 16 persons.

TORNADO SHELTER. See the definition for Storm Shelter.

WIND PRESSURE. See the definition for Design Wind Pressure.

WIND SPEED. See the definition for Design Wind Speed, Storm Shelter.

SECTION 203
SYMBOLS AND NOMENCLATURE

APC - Atmospheric pressure change
ASD – allowable stress design
C & C – components and cladding
GC_{pi} – internal pressure coefficient
LRFD – load and resistance factor design

K_d – directionality factor
K_{zt} – topographic factor
MWFRS – main wind-force resisting system
W – wind loads.

SECTION 302
LOAD COMBINATIONS

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 wind loads, W, determined in accordance with Section 304 ~~of this standard~~. Exception 1 to ASCE 7 Section 2.3.2 shall not apply.

302.2 Allowable stress design. For allowable stress design (ASD), use the load combinations stated in ASCE 7, Section 2.4 with wind loads, W, determined in accordance with Section 304 ~~of this standard~~.

304.1 General. Wind loads, *W*, shall be determined using ASCE 7, except as modified by this section.

Reason: Most of the suggestions are for:

- The use of a defined term in the definitions, consistent with the rest of the standard.
- Ordering defined terms based on how people would look for them.
- Cross references.

"Hurricane shelter" and "tornado shelter" - In looking at the defined terms, 'hurricane' and 'tornado' provide specific requirements for defined terms that use 'storm'. The references are intended to show how we indicate that this is interchangeable in the definitions and where used is the text.
'Horizontal assembly' – There is a definition for fire barrier but not for horizontal assembly (see Chapter 6). The definition for 'fire barrier' does not match the IBC and IFC definition.

"ALCOVE OR BAFFLED STORM SHELTER ENTRY SYSTEM" is revised to indicate how the term is used in Chapter 8.

"HAZARD" includes a reference to two new definitions that are types of hazards. (IS-STM 04-08-18 and 04-19-18)

"INTERIOR SURFACE OF THE SHELTER COMPONENT" is proposed to be deleted because this term was used in Section 804.10.2, but the revisions from IS-STM 08-07-18 have removed it.

"Rebound impact" uses the term to define the term. Loosing the one word would address this.

There are provisions with the work groups to address revisions to the definitions for 'critical support systems', 'occupied storm shelter areas" and "local emergency planning commission.'

The symbols listed are used in Section 107.2.1 Design information and Section 304 Wind Loads. ICC 400 does include a similar section. Does the committee feel it would be beneficial here? The changes to Section 302.1, 302.2 and 304.1 are because W is used but not described as the other symbols are. Also, the symbol is not used in Section 304, even though 302.1 and 302.2 send you there.

The following are terms new to the standard, which will be added to the list.

(IS-STM 02-01-18 AM)
APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification, where such agency ~~and~~ has been approved by the building official.

(IS-STM 04-08-18 AS)
COASTAL A ZONE. Area within a special flood hazard area, landward of a V zone or landward of an open coast without mapped *coastal high-hazard areas*. In a coastal A zone, the principal source of flooding must be astronomical tides, storm surges, seiches or tsunamis, not riverine flooding. During the base flood conditions, the potential for breaking wave height shall be greater than or equal to 1-1/2 feet (457 mm). The inland limit of the coastal A zone is one of the following:

1. The Limit of Moderate Wave Action if delineated on a FIRM.
2. Designated by the *authority having jurisdiction*.

(IS-STM 04-08-18 AS)
COASTAL HIGH-HAZARD AREA. Area within the special *flood hazard area* extending from offshore to the inland limit of a primary dune along an open coast and any other area that is subject to high-velocity wave action from storms or seismic sources, and shown on a Flood Insurance Rate Map (FIRM) or other flood hazard map as velocity Zone V, VO, VE or V1-30.

(IS-STM 04-09-18-AS)
FLOOD ELEVATION STUDY. An examination, evaluation and determination of flood hazard and, where appropriate, corresponding water surface elevations, or an examination, evaluation and determination of storm surge inundation, including coastal wave effects, associated with the maximum intensity hurricane.

(IS-STM 04-09-18-AS)
FLOOD HAZARD AREA. The greater of the following two areas:

1. The area in a floodplain subject to a 1-percent or greater chance of flooding in any year.
2. The area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated.

(IS-STM 05-06018 AM)
LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the *building* official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

(IS-STM 08-16-18 AS) ***(relocated from 802.2)***
SPECIMEN. The entire assembled unit submitted for testing, including but not limited to anchorage devices and structure to which the product is to be mounted.

(IS-STM 08-16-18 AS) ***(relocated from 802.2)***
TEST CHAMBER. An airtight enclosure of sufficient depth to allow unobstructed deflection of the specimen during pressure cycling, including ports for air supply and removal, and equipped with instruments to measure test pressure differentials.

(IS-STM 05-03-18 AM)
USEABLE STORM **SHELTER FLOOR AREAS.** The portions of the floor area within the *storm shelter envelope* not including *occupant support areas*, used to determine the maximum occupant load of the *storm shelter*.

Committee Action: As Modified (8-0)

Further modify as follows:

PROTECTED OCCUPANT AREA. The portions of the *storm shelter* area that are protected from intrusion of storm debris ~~by *alcove or baffled entry systems* in accordance with Section 804.9.7~~.

Committee Reason: Agree with reason. The modification is to clarify that other types of protection systems can use the term throughout the standard rather than just the alcove and baffled entry system.

IS-STM 02-10-18

IS-STM 02-10-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	13	1	1	0	1

Staff Notes: Assigned to work group 3.

For consistency with the rest of the definitions such as critical support systems, design occupant capacity, design wind speed, entry system. To make finding the defined term easier.

Revise as follows:

~~**SHELTER** ENVELOPE, STORM~~ **SHELTER.** The impact and pressure resistant roofs, walls and floors and the *impact-protective systems* that provide protection to occupants during a severe windstorm and meet the requirements of Chapter 3.

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		

Your comment/reason: Editorial revisions to put the load combination requirements in mandatory rather than instructive language:

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 shall be used with wind loads, W, determined in accordance with Section 304. Exception 1 to ASCE 7 Section 2.3.2 shall not apply.

302.2 Allowable stress design. For allowable stress design (ASD), ~~use~~ the load combinations stated in ASCE 7, Section 2.4 shall be used with wind loads, W, determined in accordance with Section 304.

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:			x	

Your comment/reason:

a. The definition of 'Hurricane Shelter' says 'see definition of storm shelter.,' but hurricane shelter is subset of storm shelter. Should we define here, as something like the following? Same for tornado shelter.
b. Residential storm shelter definition has repeated term 'storm shelter' that needs to be deleted. (This was due to subsequent terminology change in IS-STM 05-18-18)

Revise as follows:

HURRICANE SHELTER. A *storm shelter* specifically for use to protect occupants from hurricanes. See the definition for Storm Shelter.

STORM SHELTER. A building, structure or portion thereof, constructed in accordance with this standard, designated for use during a severe wind storm event such as a hurricane or tornado.

Community Storm Shelter. Any *storm shelter* not defined as a *residential storm shelter*. This includes both storm shelters intended for use by the general public and storm shelters intended for use by building occupants.

Residential Storm Shelter. A *storm shelter* serving occupants of dwelling units and having *a storm shelter* ~~*a storm shelter*~~ *design occupant capacity* not exceeding 16 persons.

TORNADO SHELTER. A *storm shelter* specifically for use to protect occupants from tornados. See the definition for Storm Shelter.

c. Section 203 symbols. For V, need to update the entry to be

Revise as follows:

V- Design wind speed, storm shelter

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason:
a.Why say storm shelter here if we don't say it after Design Wind Pressure

Revise as follows:

DESIGN WIND PRESSURE. The wind pressure on a specific location of the *storm shelter envelope*, as determined in accordance with Section 304, Wind Loads, which controls the design of components and cladding (C & C) of the *storm shelter envelope* or the main wind-force resisting system (MWFRS) for the *storm shelter*.

DESIGN WIND SPEED (V~~), STORM SHELTER~~. The maximum wind speed for which the *storm shelter* has been designed. Values shall be the nominal 3-second gust wind speed in miles per hour (m/s) at 33 feet (10 m) above ground for open terrain (Exposure C).

b.Coordination with how the system is illustrated in Chapter 8

Revise as follows:

ENTRY SYSTEM, ALCOVE OR BAFFLED STORM **SHELTER.** An entry system that uses walls and passageways to allow access to and egress ~~to the *storm shelter* interior~~ from the protected occupant area while providing shielding from wind-borne debris in accordance with Section 306.4.4.

c.add text

Revise as follows:

PROTECTED OCCUPANT AREA. The portions of the *storm shelter* area that are protected from

intrusion of storm debris by the storm shelter envelope.

Staff note: "protected occupant area" is used in 803.9 – alcove and baffled entry systems and 306.4.6. Where is the storm shelter envelope in a baffled entry system?

Chapter 3
STRUCTURAL DESIGN CRITERIA

IS-STM 03-02-18
ICC 500 Section 301.1.2

Proponent: Benchmark Harris, The National Storm Shelter Association (NSSA) Design Practices Committee

Revise as follows:

~~**301.1.2 Anchor calculations—doors, windows and shutters.** Where anchorage of door, window or shutter framing to the shelter structure is required by means other than those provided in the manufacturer's listing or installation instructions in accordance with Section 107, alternate anchorage shall be designed for pull-out and shear and the anchor placement detailed in accordance with accepted engineering practice. The alternate anchorage details and calculations shall be provided as part of the construction documents.~~

301.1.2 Anchor calculations- impact-protective systems. Anchorage of impact-protective systems to the shelter structure shall be designed to resist debris impacts and wind pressure. It shall be permitted for the structural design of the anchor to consider debris impact loading separately from wind pressure loading. Each anchor shall be designed for debris impact loading perpendicular to the main plane of the impact-protective system by at least one of the following methods:

1. Successful testing in accordance with Chapter 8 by an accredited laboratory with the impact-protective system specified and type of shelter structure specified to receive the impact-protective system:
2. Engineering design using a 1.0 load factor with a design debris impact load determined using engineering judgment that is based on the calculated ultimate capacity of anchors successfully tested in accordance with Chapter 8 by an accredited laboratory with the impact-protective system specified and a more rigid type of shelter structure than the one specified to receive the impact-protective system; or,
3. Engineering design using a 1.0 load factor with a design debris impact load of 6 kips at any location on the impact-protective system.

Reason:

Alternative anchor design using engineering judgment may be required if an impact protective system has not been tested with a structure as rigid as is proposed for a shelter. Alternative anchor design using engineering judgment may also be required to modify original designs during construction if contractors mis-install anchors and/or impact-protective systems. Considering the absence of data available at this time on how much load is imparted by the standardized 2x4 debris impact and the variability of impact-protective device flexibility, the value

of 6 kips is believed to be an upper bound of the force associated with the model test debris, based on the design shear strength of the 3/8" diameter Grade 5 bolts used by Texas Tech University in their standard missile impact testing frames for decades without any of these bolts failing. The Nominal Shear Strength of these bolts is 7,952 pounds according to the attached table from Nucor which is based on AISC. AISC Table J3.2 indicates that the appropriate phi factor to determine the design strength is 0.75. Therefore, the design shear strength of each of these bolts is 0.75 x 7,952 pounds = 5,964 pounds. It is thought appropriate to use a phi factor because a number of bolts were used along the jambs and head of the frame which provides a greater statistical distribution of properties represented by the phi factor which addresses material and installation variations, and furthermore, the use of the shear value is conservative because it ignores the unknown amount of bending which would create additional stresses on the bolt making the shear-only analysis conservative.

SHEAR STRENGTH

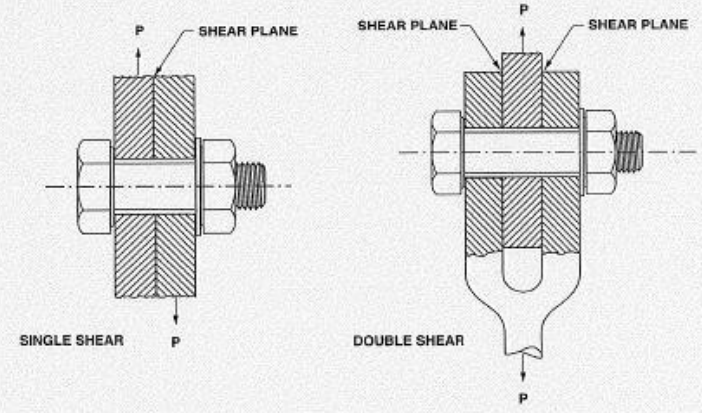
NUCOR FASTENER

TECHNICAL DATA SHEET

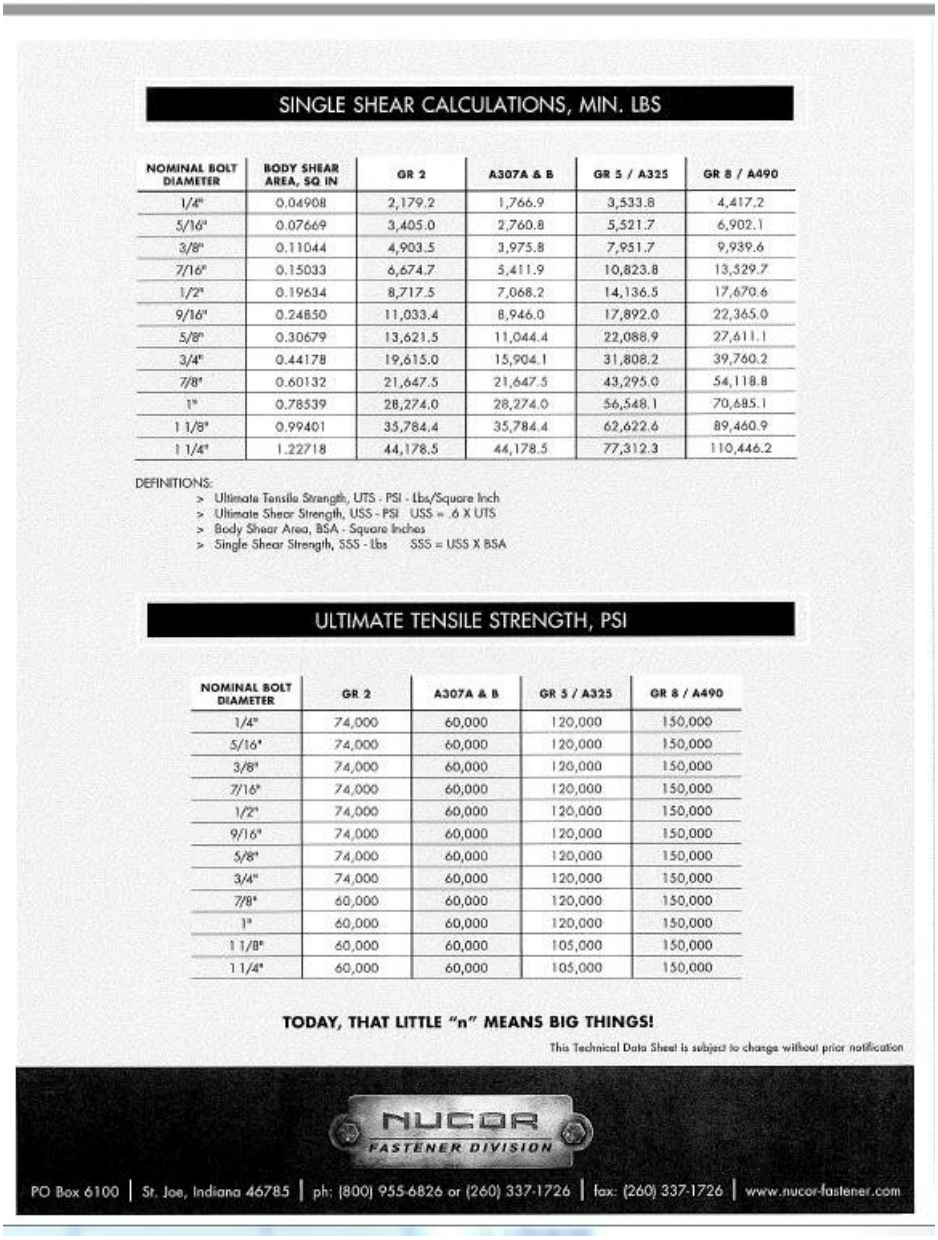
Shear Strength is defined as the maximum load typically applied normal to a fastener's axis that can be supported prior to fracture. Single shear is load applied in one plane that would result in the fastener being cut into two pieces, while double shear would result in three fastener pieces.

Single shear values for fasteners are typically calculated based upon the nominal body diameter or body shear area, BSA. See the definitions following the table below. An appropriate factor of safety must be applied to the calculated Single Shear Strength values by the Engineer of Record.

SHEAR CONFIGURATIONS



TDS-013 2-18-08



SINGLE SHEAR CALCULATIONS, MIN. LBS

NOMINAL BOLT DIAMETER	BODY SHEAR AREA, SQ IN	GR 2	A307A & B	GR 5 / A325	GR 8 / A490
1/4"	0.04908	2,179.2	1,766.9	3,533.8	4,417.2
5/16"	0.07669	3,405.0	2,760.8	5,521.7	6,902.1
3/8"	0.11044	4,903.5	3,975.8	7,951.7	9,939.6
7/16"	0.15033	6,674.7	5,411.9	10,823.8	13,529.7
1/2"	0.19634	8,717.5	7,068.2	14,136.5	17,670.6
9/16"	0.24850	11,033.4	8,946.0	17,892.0	22,365.0
5/8"	0.30679	13,621.5	11,044.4	22,088.9	27,611.1
3/4"	0.44178	19,615.0	15,904.1	31,808.2	39,760.2
7/8"	0.60132	21,647.5	21,647.5	43,295.0	54,118.8
1"	0.78539	28,274.0	28,274.0	56,548.1	70,685.1
1 1/8"	0.99401	35,784.4	35,784.4	62,622.6	89,460.9
1 1/4"	1.22718	44,178.5	44,178.5	77,312.3	110,446.2

DEFINITIONS:
- Ultimate Tensile Strength, UTS - PSI - Lbs/Square Inch
- Ultimate Shear Strength, USS - PSI USS = .6 X UTS
- Body Shear Area, BSA - Square Inches
- Single Shear Strength, SSS - Lbs SSS = USS X BSA

ULTIMATE TENSILE STRENGTH, PSI

NOMINAL BOLT DIAMETER	GR 2	A307A & B	GR 5 / A325	GR 8 / A490
1/4"	74,000	60,000	120,000	150,000
5/16"	74,000	60,000	120,000	150,000
3/8"	74,000	60,000	120,000	150,000
7/16"	74,000	60,000	120,000	150,000
1/2"	74,000	60,000	120,000	150,000
9/16"	74,000	60,000	120,000	150,000
5/8"	74,000	60,000	120,000	150,000
3/4"	74,000	60,000	120,000	150,000
7/8"	60,000	60,000	120,000	150,000
1"	60,000	60,000	120,000	150,000
1 1/8"	60,000	60,000	105,000	150,000
1 1/4"	60,000	60,000	105,000	150,000

TODAY, THAT LITTLE "n" MEANS BIG THINGS!

This Technical Data Sheet is subject to change without prior notification

NUCOR FASTENER DIVISION

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Staff Note: This text is repeated in Section 306.6. Should this proposal be relocated there and both Section 301.1.2 and 306.6 replaced?

> **306.6 Anchorage of doors, windows and shutters.** Where anchorage of door, window or shutter framing to the shelter structure is required by means other than those provided in the manufacturer's listing or installation instructions in accordance with Section 107, alternate anchorage shall be designed for pull-out and shear and the anchor placement detailed in accordance with accepted engineering practice. The alternate anchorage details and calculations shall be provided as part of the construction documents.

Committee Action: Approved as modified (7-0 on 5-09-19)(10-0 on 5-23-19)

Replace with the following:

~~**301.1.2 Anchor calculations—doors, windows and shutters.** Where anchorage of door, window or shutter framing to the shelter structure is required by means other than those provided in the manufacturer's listing or installation instructions in accordance with Section 107, alternate anchorage shall be designed for pull-out and shear and the anchor placement detailed in accordance with accepted engineering practice. The alternate anchorage details and calculations shall be provided as part of the construction documents.~~

306.6 Anchorage ~~of doors, windows and shutters~~ for impact-protective systems. Where anchorage of ~~door, window or shutter framing~~ impact-protective systems to the shelter structure is required by means other than those provided in the manufacturer's listing ~~or installation instructions~~ in accordance with Section 107, ~~alternate~~ anchorage shall be designed for pull-out and shear to resist the design wind pressures as determined in accordance with Section 304. ~~and the anchor placement detailed in accordance with accepted engineering practice. The alternate anchorage details and calculations shall be provided as part of the construction documents~~.

Committee Reason: Section 301.1.2 and 306.6 are the same text, so delete 301.1.2 and modify 306.6. Revise language for consistency with previous proposals regarding impact protective systems. The revised language indicates that this is for wind pressure, not debris impact loads.

Need to look for "as defined" in the standard to revise this in the codes.

IS-STM 03-02-18

		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**15**	**0**	**0**	**0**	**1**
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC		**x**		

Your comment/reason: Should this be more generally "wind loads"?

No revisions suggested:

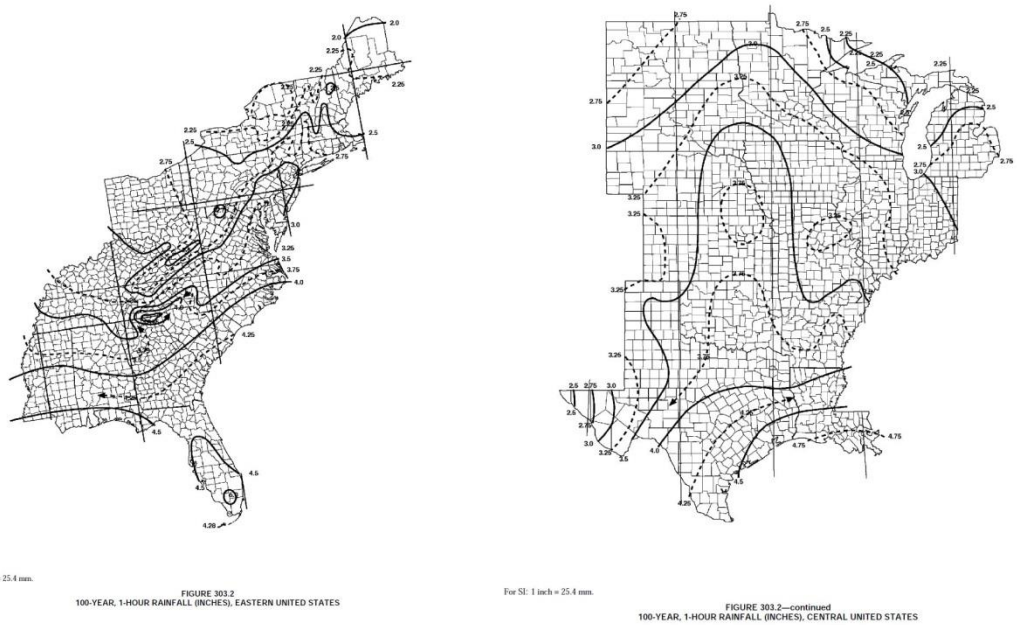
306.4.5 Anchorage for *impact-protective systems*. Where anchorage of *impact-protective systems* to the *storm shelter* structure is required by means other than those provided in the manufacturer's listing in accordance with Section 107, anchorage shall be designed for pull-out and shear to resist the *design wind pressures* on the *storm shelter envelope* as determined in accordance with Section 304.

IS-STM 03-04-18
ICC 500 Sections 303.1.1, 703.8.1, 703.8.2, 703.8.3 and Figure 303.2

Proponent: Crystal Wespestad, representing self

Revise as follows:

303.1.1. Rainfall rate. The rainfall rate shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the rainfall rate established from Figure ~~303.2~~ 303.1.1.



For SI: 1 inch = 25.4 mm.

FIGURE 303.2
100-YEAR, 1-HOUR RAINFALL (INCHES), EASTERN UNITED STATES

For SI: 1 inch = 25.4 mm.

FIGURE 303.2—continued
100-YEAR, 1-HOUR RAINFALL (INCHES), CENTRAL UNITED STATES

FIGURE ~~303.2~~ 303.1.1
100-YEAR, 1-HOUR RAINFALL (INCHES), EASTERN/CENTRAL UNITED STATES
(Add figure for Western United States, Hawaii, Alaska and the American territories listed in ICC 500 Figure 304.2.1)

303.2 Roof live loads. Storm shelter roofs shall be designed for minimum live loads specified in ASCE 7, but not less than the following:
Tornado shelters: 100 pounds per square foot (4.8 kN/m2)
Hurricane shelters: 50 pounds per square foot (2.4 kN/m2)

703.8 Rainwater drainage for hurricane shelter facilities.

703.8.1 Rainfall rate for the primary roof drainage system. Rainfall rate for the primary roof drainage system of a hurricane shelter shall be determined by adding 3

inches (76.2 mm) of rainfall per hour to the rainfall rate established from Figure ~~303.2~~ 303.1.1.

703.8.2 Rainfall rate for the secondary (overflow) drainage systems. The rainfall rate for the secondary (overflow) 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~~ 303.1.1.

703.8.3 Rainwater drainage for hurricane shelter facilities. Rainwater drainage shall be provided for hurricane shelter 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~~ 303.1.1.

Reason: Figure 303.2 is referenced in Section 303.1.1 and not in Section 303.2. Section 303.2 has nothing to do with the figure.
The standard is required where someone choses to build a shelter, which could be outside of these areas. Many combination hurricane and tornado shelters are being constructed. There should be a figure for the rainfall in the Western United States, Hawaii, Alaska, and islands south of Florida in case someone wants to build a shelter in those areas. Is this drawing in ASCE 7? I did not have access to a suggested map.

Staff note: See IS-STM 07-16-18
See 2018 IBC Figure 1611.1 for 100-Year, 1- Hour Rainfall (Inches) for Western United States , Alaska and Hawaii.

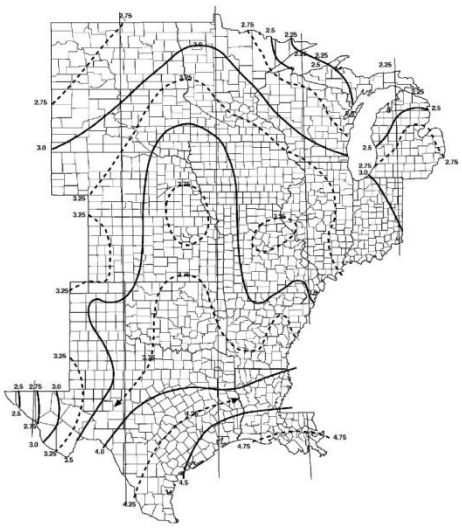
Committee Action: Approved as modified (12-0) Reconsideration on 8-01-19 (9-0)
Approved as further modified on 8-27-19 (8-0)

Replacing with the follows:

303.1.1. Rainfall rate. The rainfall rate shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate established from Figure ~~303.2~~ 303.1.1. For locations not illustrated in the figure, determine the 100 year, 1-hour rainfall rate from approved local weather data.

For SI: 1 inch = 25.4 mm.

FIGURE 303.2
100-YEAR, 1-HOUR RAINFALL (INCHES), EASTERN UNITED STATES



For SI: 1 inch = 25.4 mm.

FIGURE 303.2—continued
100-YEAR, 1-HOUR RAINFALL (INCHES), CENTRAL UNITED STATES

FIGURE ~~303.2~~ 303.1.1
100-YEAR, 1-HOUR RAINFALL (INCHES), EASTERN/CENTRAL UNITED STATES
(Add figure for Western United States, Hawaii, Alaska and the American territories listed in ICC 500 Figure 304.2.1) 10-19-2018: See IS-STM-07-15-18 for Hawaii Map

303.2 Roof live loads. Storm shelter roofs shall be designed for minimum live loads specified in ASCE 7, but not less than the following:
Tornado shelters: 100 pounds per square foot (4.8 kN/m2)
Hurricane shelters: 50 pounds per square foot (2.4 kN/m2)

703.8 Rainwater drainage for hurricane shelter facilities.

703.8.1 Rainfall rate for the primary roof drainage system. Rainfall rate for the primary roof drainage system of a hurricane shelter shall be determined by adding 3 inches (76.2 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate established from Figure ~~303.2~~ 303.1.1. For locations not illustrated in the figure, determine the 100 year, 1-hour rainfall rate from approved local weather data.

703.8.2 Rainfall rate for the secondary (overflow) drainage systems. The rainfall rate for the secondary (overflow) drainage systems shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate established from Figure ~~303.2~~ 303.1.1. For locations not illustrated in the figure, determine the 100 year, 1-hour rainfall rate from approved local weather data

703.8.3 Rainwater drainage for hurricane shelter facilities. Rainwater drainage shall be provided for hurricane shelter 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 100-year, 1-hour rainfall rate established from Figure ~~303.2~~ 303.1.1. For locations not illustrated in the figure, determine the 100 year, 1-hour rainfall rate from approved local weather data.

Committee Reason: Adding the phrase allows for design outside of the range of the maps. The illustration correction is editorial.

Reconsideration - Further modify as follows:

303.1.1. Rainfall rate. The rainfall rate shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate. The 100-year, 1-hour rainfall rate shall be determined ~~established~~ from Figure 303.1.1~~. For locations not illustrated in the figure, determine the 100 year, 1-hour rainfall rate~~ or ~~from~~ approved local weather data.

703.8 Rainwater drainage for hurricane shelter facilities.

703.8.1 Rainfall rate for the primary roof drainage system. Rainfall rate for the primary roof drainage system of a hurricane shelter shall be determined by adding 3 inches (76.2 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate . The 100-year, 1-hour rainfall rate shall be determined ~~established~~ from Figure 303.1.1~~. For locations not illustrated in the figure, determine the 100 year, 1-hour rainfall rate~~ or ~~from~~ approved local weather data.

703.8.2 Rainfall rate for the secondary (overflow) drainage systems. The rainfall rate for the secondary (overflow) drainage systems shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate. The 100-year, 1-hour rainfall rate shall be determined ~~established~~ from Figure 303.1.1~~. For locations not illustrated in the figure, determine the 100 year, 1-hour rainfall rate~~ or ~~from~~ approved local weather data.

703.8.3 Rainwater drainage for hurricane shelter facilities. Rainwater drainage shall be provided for hurricane shelter 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 100-year, 1-hour rainfall rate . The 100-year, 1-hour rainfall rate shall be determined ~~established~~ from Figure 303.1.1~~. For locations not illustrated in the figure, determine the 100 year, 1-hour rainfall rate~~ or ~~from~~ approved local weather data.

Reconsideration Committee reason: Users should be able to use data such as NOAA, or local weather maps, or analysis of local weather history.

IS-STM 03-04-18

		Committee action: Approval as Further Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	**13**	**2**	**0**	**0**	**0**
Staff Notes: Scott vote is errata.					

		Committee action: Approval as Further Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Schultz Vote:		**x**		

Your comment/reason: *303.1.1 Rainfall rate states "or from approved local weather data". It is unclear who is the approver of this data?*

No revisions suggested.

303.1.1. Rainfall rate. The rainfall rate shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate. The 100-year, 1 hour rainfall rate shall be determined from Figure 303.1.1 or approved local weather data.

		Committee action: Approval as Further Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Scott Vote:		**x**		

Your comment/reason: Editorial – "Western" in Western United States map caption is spelled wrong (Westerm)

Revise as follows:

FIGURE 303.1.1**—continued**
100-YEAR, 1-HOUR RAINFALL (INCHES), WESTERN ~~WESTERM~~ UNITED STATES

IS-STM 03-09-18
ICC 500 Figure 304.2(2)

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

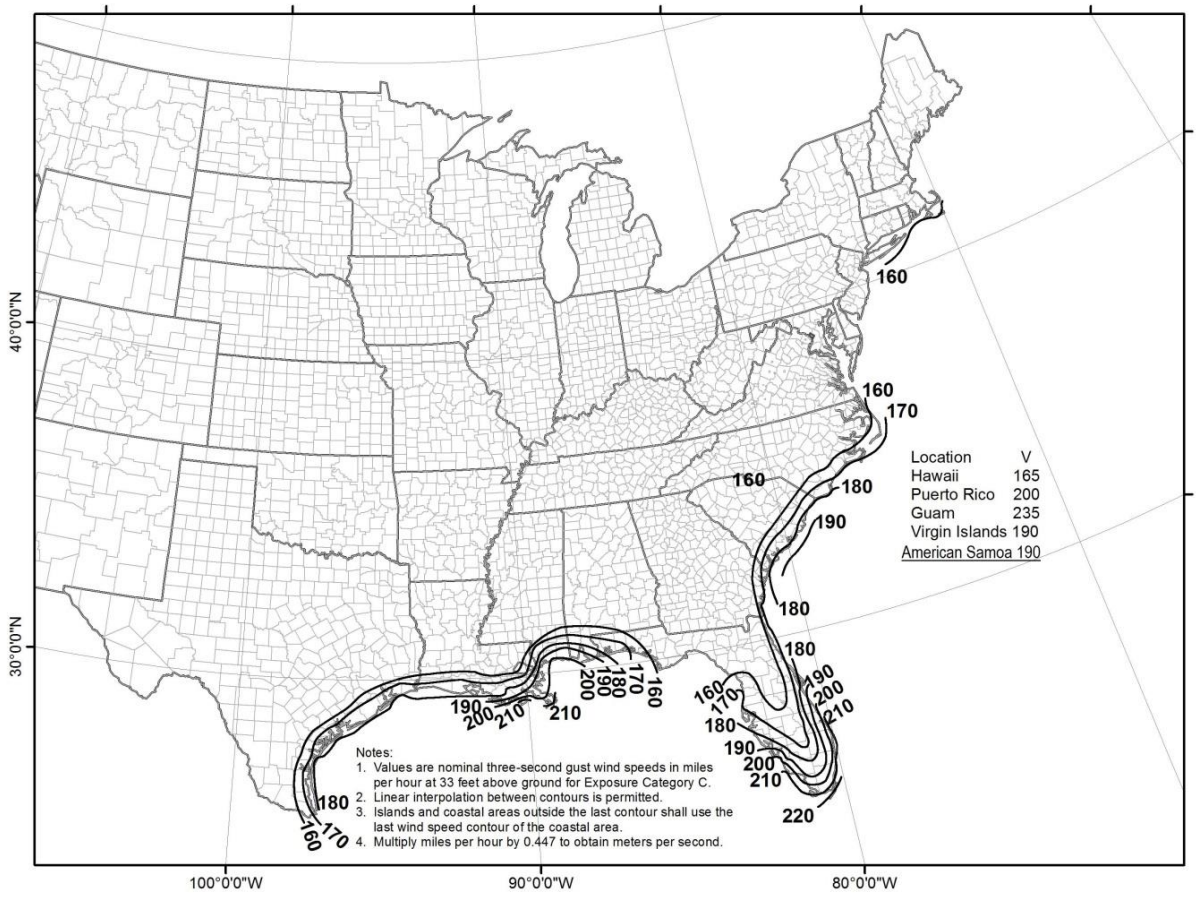


Figure 304.2(2) SHELTER DESIGN WIND SPEEDS FOR HURRICANES

Reason: Currently Figure 304.2(2), the Shelter Design Wind Speeds for Hurricanes, does not specify a design wind speed for American Samoa where hurricanes are the greatest high wind hazard, and a 10,000 year MRI analysis is not currently available. From the ASCE 7 wind speed maps for 300, 700, 1700, and 3000 years, it turns out that the Virgin Islands and American Samoa wind speeds at each of these return periods are almost identical, meaning the hazard curves have a similar shape at the two locations. On the ASCE 7-16 Risk Category IV map,

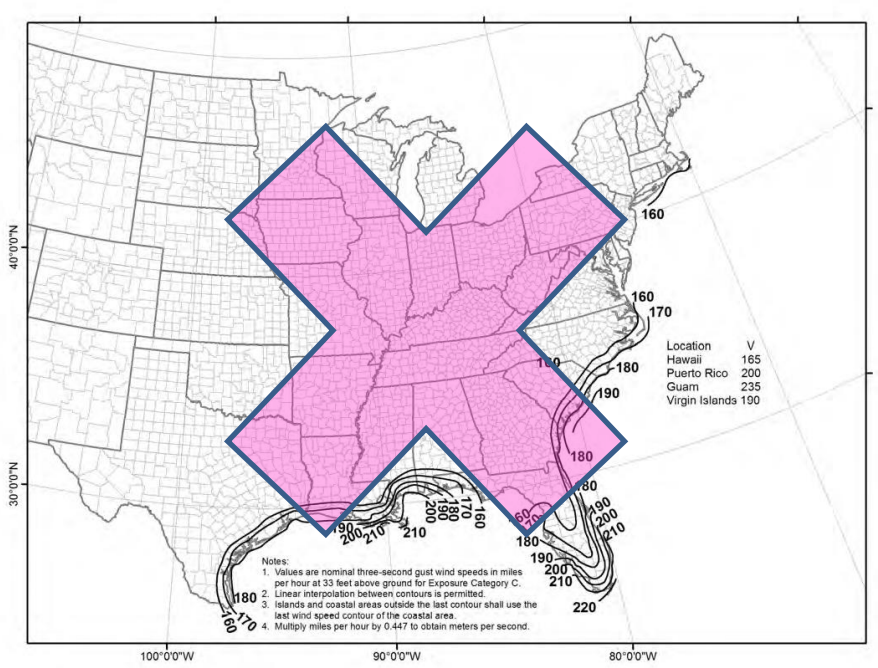
American Samoa and the US Virgin Islands both have design wind speed of 180 mph. Therefore, the proposed wind speed for American Samoa is the same as the 10,000 year MRI wind speed that is currently used for the US Virgin Islands, 190 mph.

Committee Action: Approved as Modified (10-0)

Notes: Will also revise name for US Virgin Islands and add Commonwealth of the Northern Mariana Islands and American Samoa to full map. ARA will provide revised map for standard.
Rotate maps to landscape in final draft.
Add footnote with reference to wind speeds that are electronically available at ATC – Marc Levitan will provide electronic address.

Replace with the following:

Delete four current maps and replace with the following



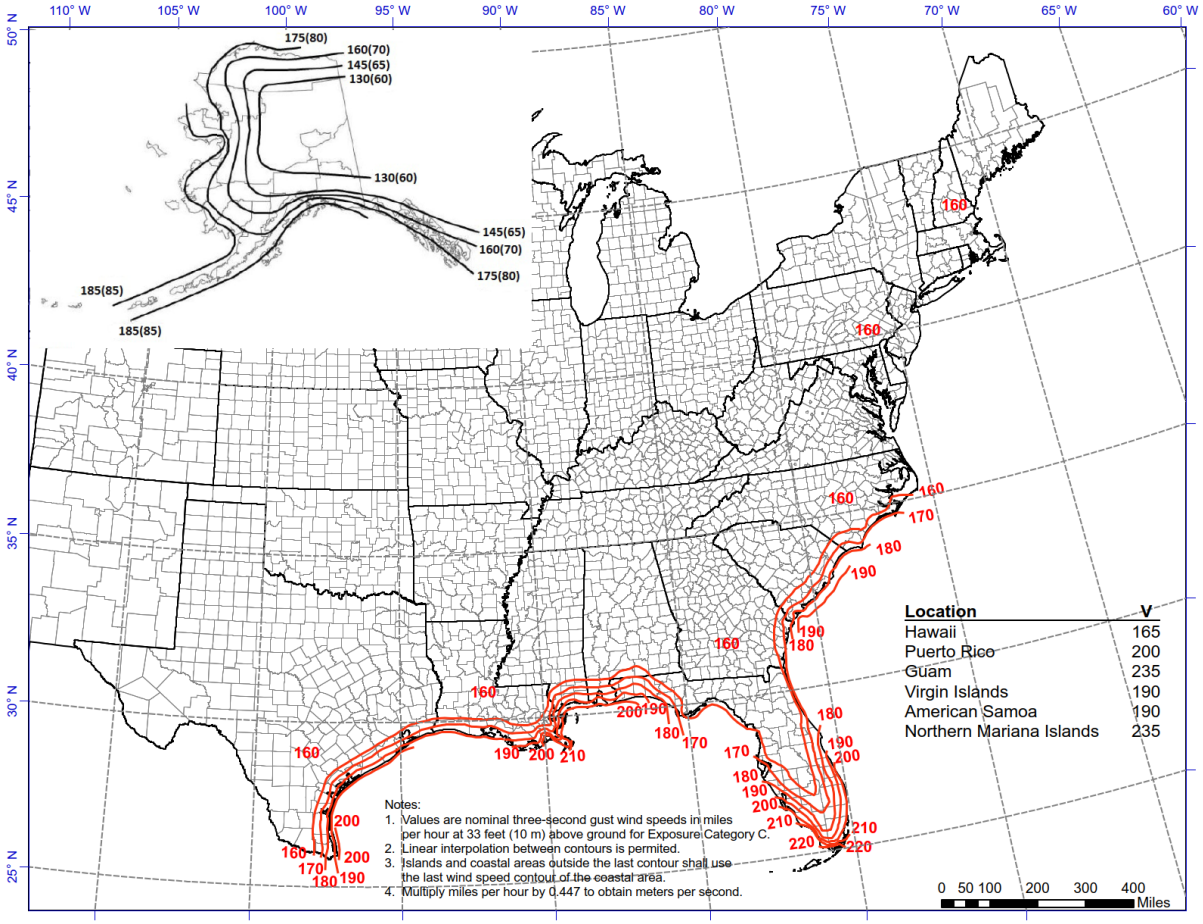


FIGURE 304.2(2)
STORM ***SHELTER DESIGN WIND SPEEDS, V,*** **FOR HURRICANES**

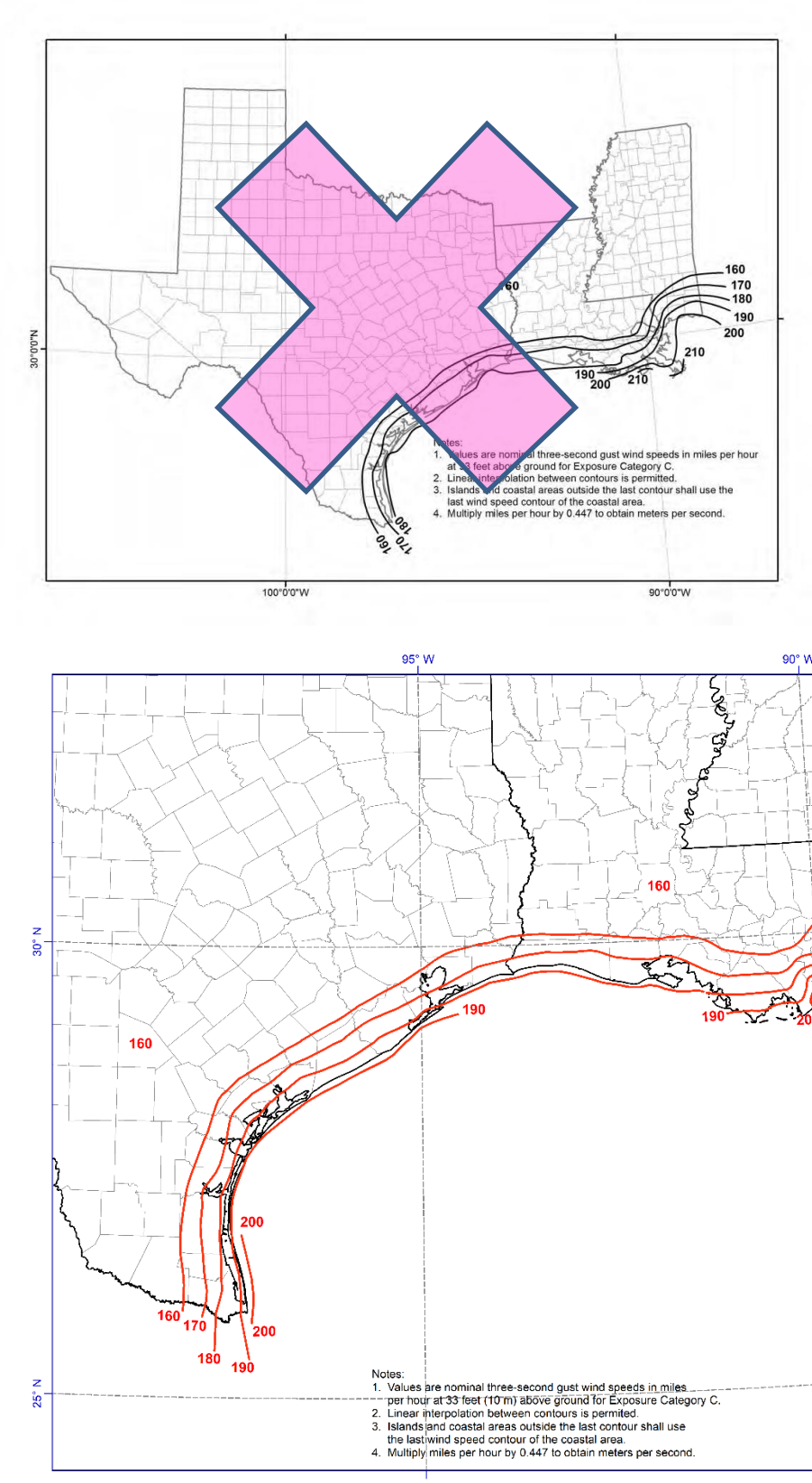
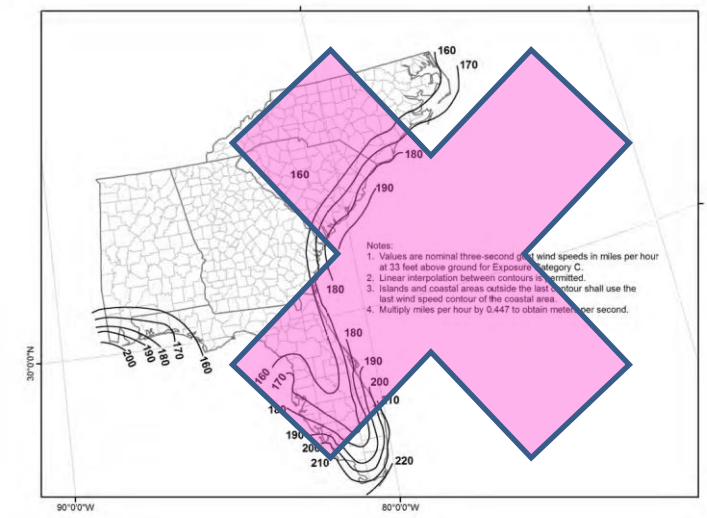


FIGURE 304.2(2)—continued
STORM ***SHELTER DESIGN WIND SPEEDS, V,*** **FOR HURRICANES—WESTERN GULF OF MEXICO**



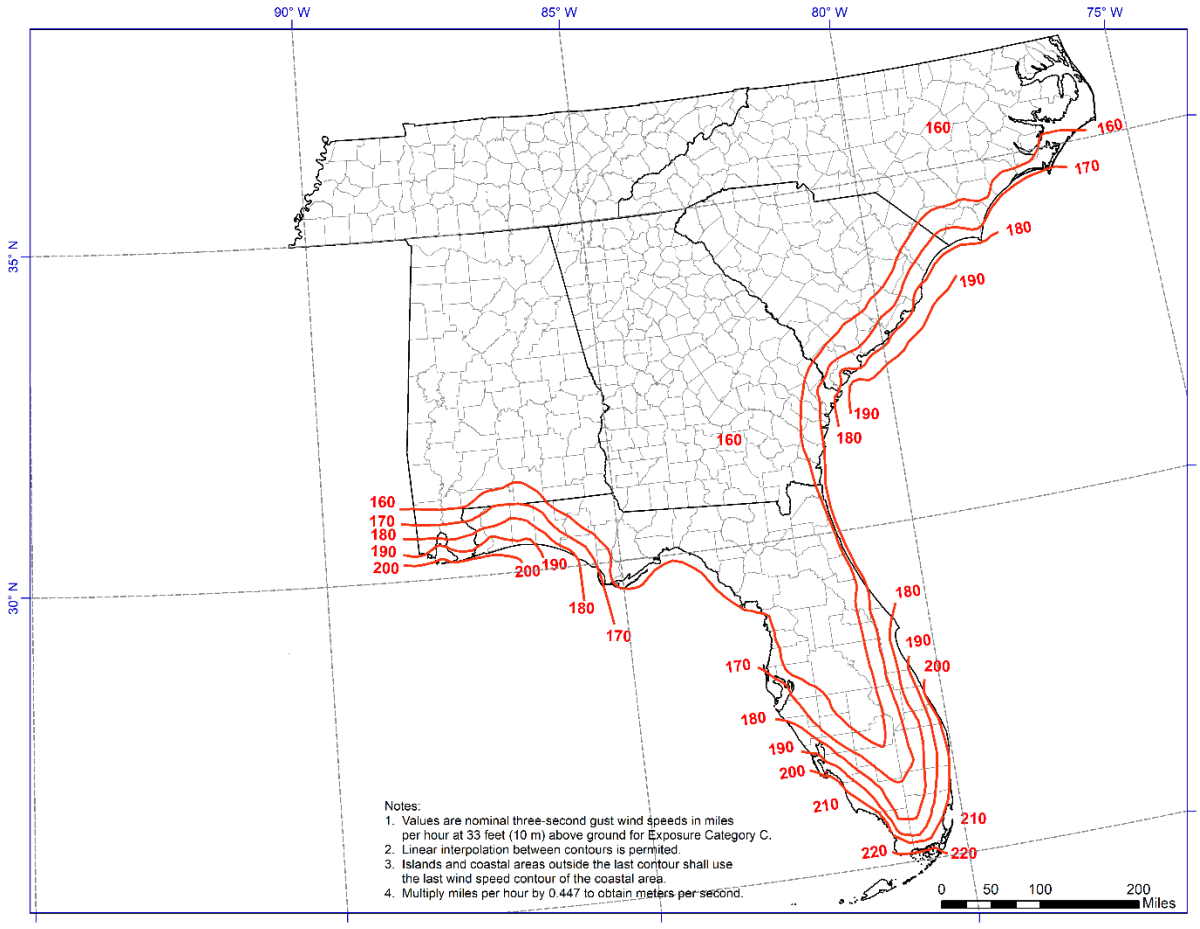
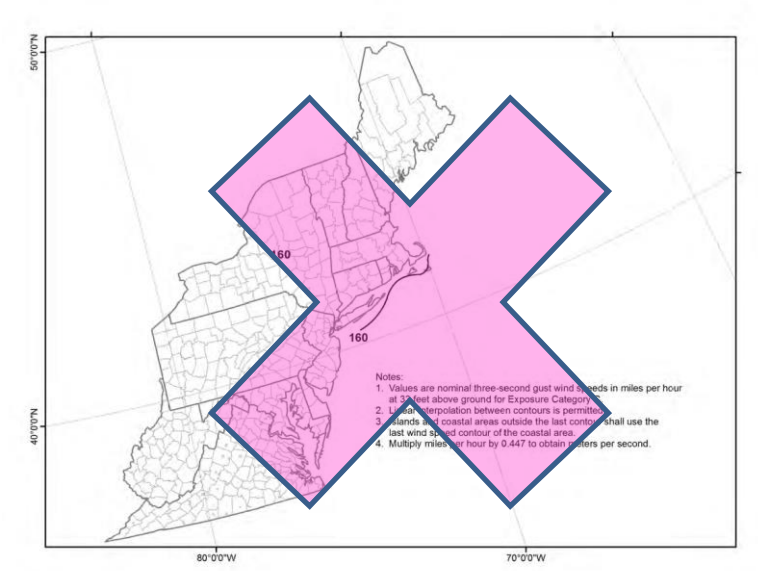


FIGURE 304.2(2)—continued
STORM ***SHELTER DESIGN WIND SPEEDS, V,*** **FOR HURRICANES—EASTERN GULF OF MEXICO AND SOUTHERN ATLANTIC**



~~FIGURE 304.2(2)—continued~~
~~*SHELTER DESIGN WIND SPEED* FOR HURRICANES—MID-NORTHERN ATLANTIC~~

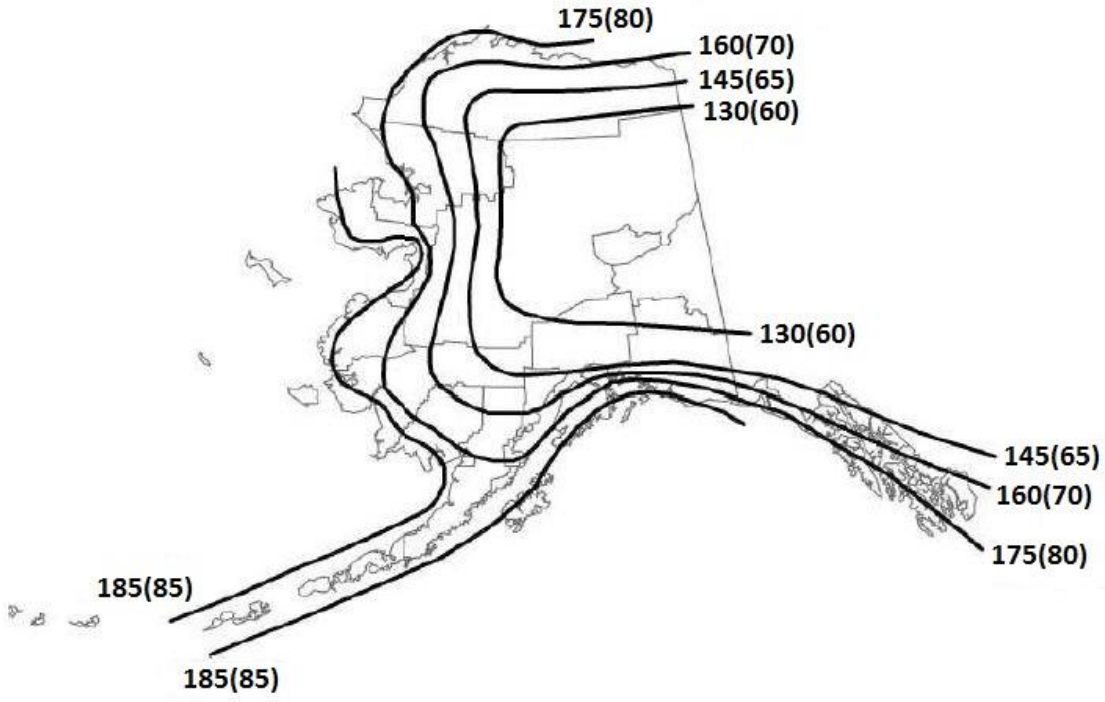


FIGURE 304.2(2)- continued
***STORM SHELTER DESIGN WIND SPEEDS, V,* FOR HURRICANES - ALASKA**

Committee Reason:. Revised maps to coordinate with latest information for hurricane winds. Add Alaska because that state is affected by hurricane winds. Full list of islands is needed.

IS-STM 03-09-18

		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	13	2	0	0	0
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:		x		

Your comment/reason:
a.While Alaska has coastal storms with hurricane force winds, they are not hurricanes, but rather, extratropical storms. Suggest we consider removing Alaska map from the first 304.2.2 (whole US map), renaming the 304.2(2) continued figure to simply state Shelter Design Wind Speeds V for Alaska (or better yet, renumbering the Alaska only map as 304.2(3). We would also need to add commentary here explaining that Alaska experiences strong coastal storms form extratropical cyclones. While meteorologically different in nature, impacts at a physical location are similar to those of hurricanes, strong winds, rain, storm surge, etc.

Revise as follows:

304.2 Design wind speed. For *tornado shelters*, the *storm shelter design wind speed, V,* shall be in accordance with Figure 304.2(1). For *hurricane shelters*, the *storm shelter design wind speed* shall be in accordance with Figure 304.2(2). For storm shelters in Alaska, the *storm shelter design wind speed* shall be in accordance with Figure 304.2(3), and wind load procedures for hurricane shelters shall be used.

FIGURE 304.2(2)
STORM ***SHELTER DESIGN WIND SPEEDS, V,*** **FOR HURRICANES**
(Remove Alaska from map; reorder list of islands into alphabetical order, change Virgin Islands to US Virgin Islands, and Northern Mariana Islands to Commonwealth of the Northern Mariana Islands)

FIGURE ~~304.2(2) —continued~~ 304/2(3)
STORM ***SHELTER DESIGN WIND SPEEDS, V,*** **FOR ~~HURRICANES –~~ ALASKA**

b.Add reference to ATC wind speed data. A similar note is already included on the wind maps in IBC 2018 in Figure 1609.3. I have spoken with Jon Heintz, executive director of ATC, and he is interested for ATC to add these wind speeds to their web tool. The tornado wind speeds are already included on their web site, in beta version (although with incorrect metadata saying that these tornado speeds are from ASCE 7, which I have recently pointed out to Jon.)

(Add the following note to every map in Figure 304.2(1), 304.2(2) and 304.2(3))
Location-specific storm shelter design wind speeds shall be permitted to be determined using the ATC Hazards by Location web site https://hazards.atcouncil.org/.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: Editorial – does it need to list the full name of the "Commonwealth of the Northern Mariana Islands" on Figure 304.2(2)?

Also note in the committee action and I don't see the footnote: Add footnote with reference to wind speeds that are electronically available at ATC – Marc Levitan will provide electronic address.

Staff note: See Levitan comments for IS-STM 03-09-18

IS-STM 03-10-18
ICC 500 Section 304.6

Proponent: Andrew Herseth, Marc Levitan, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA and National Institute of Standards and Technology

Revise as follows:

304.6 Enclosure classifications. Enclosure classifications for storm shelters shall be determined in accordance with ASCE 7, Section ~~6.2~~ 26.12. 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.

Reason: The correct section for enclosure classifications of storm shelters is in ASCE 7-16 is Section 26.12.

Committee Action: Approved as Modified (11-0)

Further revise as follows:

304.6 Enclosure classifications. Enclosure classifications for storm shelters shall be determined in accordance with ASCE 7~~, Section 26.12~~. 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.

Committee Reason: Specific sections change over time. The specific reference can be addressed in the commentary.

IS-STM 03-10-18

		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**13**	**2**	**0**	**0**	**0**
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Levitan Vote:		**x**		

Your comment/reason:

In 304.6, the impact protective system might be larger than the opening (e.g. many external shutter products). If the impact protective system fails, the 'opening' will be at max equal to the rough opening size in the envelope, assuming protective system, and then door or window completely disappear. Revise text as below to clarify.

Revise as follows:

304.6 Enclosure classifications. Enclosure classifications for *storm shelters* shall be determined in accordance with ASCE 7. For determining the enclosure classification for *community storm shelters*, the largest ~~*impact-protective system*~~ protected opening on a wall that receives positive external pressure shall be considered as an opening.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: We had removed the section number with the reason that changes over time so we would only refer to ASCE 7, but that seems to have been lost with other references throughout the standard because there are a lot that still have the section number. I think we should add it back in here for consistency instead of putting it in the commentary as the note says.

Revise as follows:

304.6 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 *impact-protective system* on a wall that receives positive external pressure shall be considered as an opening.

IS-STM 03-11-18
ICC 500 Section 304.10 (New)

Proponent: Benchmark Harris, The National Storm Shelter Association (NSSA) Design Practices Committee

Revise as follows:

304.10. Required wind pressure rating for impact-protective systems. The construction documents shall specify the minimum required wind pressure ratings for any impact-protective systems. This required wind pressure rating shall be at least 0.6 multiplied by the unfactored "components and cladding" net wind pressure, accounting for both interior and exterior wind pressure, with the exterior pressure based on external pressure coefficients associated with an effective tributary area of either an assumed 10 square feet or a larger area that the manufacturer indicates is the smallest effective tributary area for any component in the system.

Reason:

ICC 500-2014 Chapter 8 requires that impact-protective systems be pressure tested over the entire area of the impact-protective system up to 1.2 or 1.5 times the rated pressure. However, ASCE 7-16 requires that wind pressures be determined considering the effective tributary area of components and cladding, external pressure coefficients increasing with decreasing tributary area and reaching a maximum "plateau" external pressure coefficient at an effective tributary area of 10 square feet. Typically storm doors, storm shutters and many other impact-protective systems have some components that have a smaller effective tributary area than the overall area of the device and even an area less than 10 square feet, such as bottom strikes for storm doors. The only way to verify that an impact-protective system that was pressure tested over the entire area of the device will not be exposed to wind pressures greater than tested for any component in the system that could fail is for the design professional to calculate the minimum required wind pressure rating based on the most conservative effective tributary area of 10 square feet unless a larger area is justified by the geometry of the manufactured components. Manufacturers often do not disclose their proprietary information related to dimensions of their internal components and so this information must be conservatively assumed unless it is provided by the manufacturer. Most storm door and storm shutter systems do not have significantly larger minimum effective tributary areas.

The unfactored wind pressure is multiplied by 0.6 using allowable stress design, which is the intent for this application. The commentary to ICC 500-2014 Section 304.1 states that both allowable stress design and strength design are permitted for this application, when the commentary language should simply clarify that only allowable stress design values are required. Allowable stress design multiplies the unfactored wind pressure times a value of 0.6 whereas strength design would use a value of 1.0, creating a circumstance in which strength design would never provide a more economical solution. Furthermore, it is not appropriate to compare a strength design level of wind pressure with an allowable load determined by pressure testing with a minimum factor of safety of 1.2 or 1.5 intended for comparison with service level wind pressures.

Committee Action: As Modified (9-0)

Replace with the following:

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: Residential or community 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 *storm shelter design wind speed*, V, mph (m/s).
4. The wind exposure category (indicate all if more than one is used).
5. The internal pressure coefficient, GC_{pi}.
6. The topographic factor, K_{zt}.
7. The directionality factor, K_d.
8. *Design wind pressures* and their applicable zones with dimensions needed for the specification of the components and cladding of the *storm shelter envelope*, psf (kN/m^2).
8. A statement that the shelter has~~/~~ or has not been constructed within an area susceptible to flooding in accordance with Chapter 4 ~~of this standard~~.
9. The Design Flood Elevation and Base Flood Elevation for the site (if applicable).
10. 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~~.
11. A floor plan drawing or image indicating location of the storm shelter on a site or within a building or facility; including a drawing or image indicating the entire facility.
12. 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. 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 (square inches) provided and locations in the shelter.
17. Calculations for the number of sanitation facilities for community shelters.
18. Minimum foundation capacity requirements.
19. Shelter installation requirements, including anchor location and minimum required capacity for each anchor.
20. For hurricane shelters, the rainfall rate of the roof primary drainage system.
21. For hurricane shelters, the rainfall rate of the roof secondary (overflow) drainage system where required.
22. For hurricane shelters, the rainwater drainage design rainfall rate for facilities subject to rainwater impoundment.

DESIGN WIND PRESSURE. The wind pressure on a specific location of the shelter envelope, as determined in accordance with Section 304, Wind Loads, which controls the design of components and cladding (C & C) of the shelter envelope or the main wind-force resisting system (MWFRS) for the shelter.

STORM SHELTER DESIGN WIND SPEED (V). The maximum wind speed for which the shelter has been designed. Values shall be the nominal 3-second gust wind speed in miles per hour (~~km/h~~ m/s) at 33 feet (10 m) above ground for open terrain (Exposure C).

SECTION 304
WIND LOADS

304.1 General. Wind loads and *design wind pressure* shall be determined ~~using~~ in accordance with ASCE 7 Chapters 26 through 31, except as modified by this section.

304.2 Design wind speed. For tornado shelters, the design wind speed, *V*, 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).

Figure 304.2(1) *SHELTER DESIGN WIND SPEEDS, V,* FOR TORNADOES

FIGURE 304.2(2) *SHELTER DESIGN WIND SPEEDS, V,* FOR HURRICANES

304.7 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^2) per 1,000 cubic feet (28.3 m^3) of interior shelter volume is provided. APC venting shall consist of openings in the shelter roof having a pitch ~~not greater than~~ 10 degrees or less from the horizontal or openings divided equally (within 10 percent 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 tornado shelters classified as partially enclosed buildings. An internal pressure coefficient of GC_{pi} = ±0.55 shall be used for tornado shelters where APC venting meeting the requirements of Section 304.7 is not provided, or where APC venting area requirements are not calculated.

306.6 Anchorage of doors, windows and shutters. Where anchorage of door, window or shutter framing to the shelter structure is required by means other than those provided in the manufacturer's listing or installation instructions in accordance with Section 107, alternate anchorage shall be designed for pull-out and shear ~~and the anchor placement detailed in accordance with accepted engineering practice. The alternate anchorage details and calculations shall be provided as part of the construction documents.~~ to resist the *design wind pressures* on the *storm shelter envelope.*

308.1.1 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 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.

805.3 Cyclic pressure testing after impact. Test specimens requiring cyclic pressure testing ~~to establish the ability to meet the wind pressure requirements set forth in Section 304 of this standard~~ shall be cyclic tested using the loading sequence detailed in ASTM E1886 specified to the *design wind pressure* ~~as defined in Section 304.1~~. Pressure testing procedures shall be performed as detailed in Sections 11.1 through 11.2.11 of ASTM E1886.

SECTION 806
PRESSURE TESTING PROCEDURES

806.1 Pressure testing procedures. Procedures for pressure testing wall assemblies, roof assemblies, door assemblies, window assemblies and impact-protective systems requiring pressure testing are presented in this section. *Design wind pressures* used for pressure testing of the *storm shelter envelope* shall be in accordance with Section 304.

806.2 Roof and wall assemblies. When testing of roof and wall assemblies is required, they shall be pressure tested in the as-supplied condition. Required pressure testing shall be ~~done~~ performed as detailed in ASTM E330 to ~~a pressure equal to or higher than~~ 1.2 times the ~~pressures specified in Section 304~~ *design wind pressure* or greater.

806.3 Door assemblies. Door assemblies shall be pressure tested in the as-supplied condition and, when required, they shall be static pressure tested or cyclically tested as specified in ~~the following sections:~~ Sections 806.3.1 through 806.3.2.2.

806.3.1 Door assemblies without glazing. Door assemblies without glazing that require testing to meet the qualification of Section 306.3 shall be pressure tested according to procedures specified in this section.

806.3.1.1 Door assemblies without glazing for tornado shelters. Door assemblies without glazing for use in tornado shelters shall be static pressure tested away from the door stops to a pressure of ~~at least~~ 1.2 times the ~~pressures specified in Section 304~~ *design wind pressure* or greater. Pressure tests are permitted to be conducted separately from missile impact tests.

806.3.1.2 Door assemblies without glazing for hurricane shelters. Door assemblies without glazing for use in hurricane shelters shall be static pressure proof tested away from the door stops to a pressure of ~~at least~~ 1.2 times the design wind pressure or greater, then subjected to required debris impact tests, and then to cyclic pressure tests following procedures of ASTM E1886.

Alternatively, door assemblies without glazing for hurricane shelters shall be statically pressure tested away from the door stops to a pressure of 1.5 times the design wind pressure or greater before impact tests and then to required debris impact tests. Cyclic pressure testing after impact tests is not required for these door assemblies that have been pressure tested to pressures equal to or greater than 1.5 times the design wind pressure or greater.

806.3.2 Door assemblies with glazing, sidelights or transoms. Door assemblies with glazing, sidelights or transoms shall be pressure tested according to procedures specified in this section. Where glazed openings are present, with a size of less than or equal to 12 inches by 12 inches (304.8 mm by 304.8 mm), an additional sample shall be impacted in the center of the glazed opening in accordance with Section 804 and cyclic pressure tested as detailed in Section 805.3. Where glazed openings have a dimension greater than 12 inches (304.8 mm), the glazed opening shall be treated as a window and tested in accordance with Section 806.5 of this standard.

806.3.2.1 Door assemblies with glazing, sidelights or transoms for tornado shelters. Door assemblies with glazing, sidelights or transoms for tornado shelters shall be static pressure tested away from the door stops following procedures of ASTM E330 to a pressure of ~~at least~~ 1.2 times the ~~pressures specified in Section 304~~ *design wind pressure* or greater. Pressure tests are permitted to be conducted separately from debris impact tests.

806.3.2.2 Door assemblies with glazing, sidelights or transoms for hurricane shelters. Door assemblies with glazing, sidelights or transoms for hurricane shelters shall be static

pressure proof tested away from the door stops to a pressure of ~~at least~~ 1.2 times the *design wind pressure* or greater. Any required debris impact tests shall follow pressure proof testing. After impact tests the door assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886.

806.4 Window assemblies and other glazed openings. Window assemblies and other glazed openings shall be pressure tested according to procedures specified in this section.

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* or greater following procedures detailed in ASTM E330. Pressure tests are allowed to be conducted separately from debris impact tests.

806.4.2 Window assemblies and other glazed openings for hurricane shelters. Window assemblies and other glazed openings for hurricane shelters shall be static pressure tested away from stops to a pressure of ~~at least~~ 1.2 times the *design wind pressure* or greater. Any required debris impact tests shall follow pressure proof testing. After impact tests the window assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886.

806.5 Impact-protective systems. External impact-protective systems shall be tested for the ability to withstand prescribed pressures if withstanding pressure is critical to their function when installed. Devices such as nonoperable, permanently affixed shields or cowlings whose only function is to protect against debris intrusion need not be pressure tested when the shields or cowlings have been designed and anchored to resist the design loads as determined in this standard.

806.5.1 Impact-protective systems for tornado shelters. External impact-protective systems 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 *design wind pressures* or greater ~~specified in Section 304~~. Debris impact tests and pressure tests are permitted to be conducted separately.

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

806.5.2 Opening protective devices for hurricane shelters. External 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* or greater ~~specified in Section 304~~ following the procedures specified in ASTM E330. Cyclic pressure tests conducted in accordance with Section 805.5 shall be conducted after debris impact tests.

806.6 Alcove or baffled entry systems. Any element of the entry system whose ability to resist wind-induced pressure is critical to the function of the entry system shall be designed to meet the requirements of Section 304 or shall be pressure tested in accordance with Section 806.

Committee Reason: This is a clarification term and usage for design wind pressure. Commentary needs to be revised to remove the reference to a 0.6 factor. It should remove the reference to the ASCE 7 load combinations. The language in Item 8 was modified for correlation with the 2021 IBC.

The Symbol V should be added the new section in Chapter 2 that shows the symbols used in the standard.

IS-STM 03-11-18

		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	0	1	0	0
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:			x	

Your comment/reason: .
a.In section 304.1, suggest delete the word except:

Revise as follows:

304.1 General. Wind loads, *W*, and *design wind pressure* shall be determined using in accordance with ASCE 7, Chapters 26 through 31~~, except~~ as modified by this section.

b.On Section 302 Load combinations, we have a huge hole concerning combined tornado and hurricane shelters. It could be interpreted as now written that if tornado controlled W for roof and hurricane controlled W for walls, you would mix and match the largest component. However, we can't be doing any selection of worst case until after load combination step, to make sure we don't end up mixing bits and pieces from each hazard type together in load combos step. We need a new subsection 302.3 that clarifies you do wind load design, including load combos, for tornadoes, then do wind load design including combos, for hurricanes, THEN see which controls design of a particular element or system. Insert new section as follows:

The last part of this section is trying to say that you cant shop around to get best loads, i.e., can't use ASD for tornadoes and Strength Design for hurricanes. Pick one an stick to it for both. My proposed language might need some wordsmithing.

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 wind loads, W, determined in accordance with Section 304. Exception 1 to ASCE 7 Section 2.3.2 shall not apply.

302.2 Allowable stress design. For allowable stress design (ASD), use the load combinations stated in ASCE 7, Section 2.4 with wind loads, W, determined in accordance with Section 304.

302.3 Combination storm shelters. For storm shelters providing protection from both tornadoes and hurricanes, wind loads W shall be determined separately for each storm type, and applied separately to the load combinations of either section 302.1 or 302.2, but using the same section for each storm type.

Suggested simplification –
302.3 Combination storm shelters. For storm shelters serving as both hurricane and tornado shelters, wind loads shall be determined separately for each storm type. Calculations for both storm types shall use the same load combinations.

IS-STM 03-12-18
ICC 500 Sections 305.3.1(New), 305.3.2(New)

Proponent: James Waller, representing Remagen Safe Rooms

Revise as follows:

305.3 Other debris hazards. Lay down, rollover and collapse hazards shall be considered by the design professional when determining the location of shelters on the site.

305.3.1 Design. Where storm shelters are exposed to lay down, rollover or collapse hazards, they shall be designed to resist those loads including the forces of kinetic energy resulting from impact.

305.3.2 Wheel loads. Storm shelter roofs and impact-protective systems which are exposed to wheel loads shall be designed for a specified wheel load in addition to other live loads specified in Chapter 3, or shall be designed for a minimum 200 pounds per square foot live load.

Reason:
Section 305.3.1
Purpose: To insure that storm shelters subject to collapse hazards are designed to resist the impact forces of the collapsing material.
Reasons: The dynamic forces of impact must be considered where storm shelter surfaces are impacted by falling objects. Where shelters are subject to the impact of collapsing masonry walls, chimneys, overhead mechanical equipment, and the like, these surfaces must be designed for the kinetic forces of those impacts, rather than just the dead weight of the object.

Section 305.3.2
Purpose: To insure adequate design of roofs and operable openings of storm shelters subject to wheel loads.
Reasons: Underground storm shelters in garages should be designed for wheel loads of vehicles which are to capable of occupying the garage. Exterior underground storm shelters may not be designed to support wheel loads but may receive wheel loading from vehicles or equipment travelling across the residence premises where the storm shelter is buried. A minimum of 200 pounds per square foot is a reasonable design load to prevent collapse of the storm shelter roof or operable opening if accidentally driven over by vehicles or equipment, even if damage occurs to the storm shelter.

Wheel load on an operable opening to an underground storm shelter

Staff note: The proposal did not indicate a title.

Committee Action: Approved as Modified (9-0)

Replace with the following:

SECTION 202
DEFINITIONS

HAZARDS.

~~**Collapse**~~ **Falling debris.** ~~Debris from wind damage to adjacent, taller structures that could fall onto the shelter.~~ Exterior components, cladding, and appurtenances, such as parapet walls, masonry cladding, or rooftop equipment, that could fall onto the roof of a storm shelter from wind damage to adjacent, taller buildings or taller sections of a host building.

Laydown. Nearby structures other than buildings, such as self-supporting towers, poles or large trees, that could fall onto the roof of a storm shelter, ~~if the shelter is within the laydown radius of the structure.~~

~~**Rollover.** Vehicles and small buildings, such as temporary classroom buildings, that could roll over due to extreme winds and impact the shelter.~~

SECTION 303
LOADS
….

303.6 Wheel loads. Storm shelters roofs subject to vehicle loads shall be designed for vehicle loads in accordance with the International Building Code Section 1607, the International Residential Code Section R301.5, or ASCE 7 Section 4.10 as applicable.

SECTION 305
DEBRIS HAZARDS

….

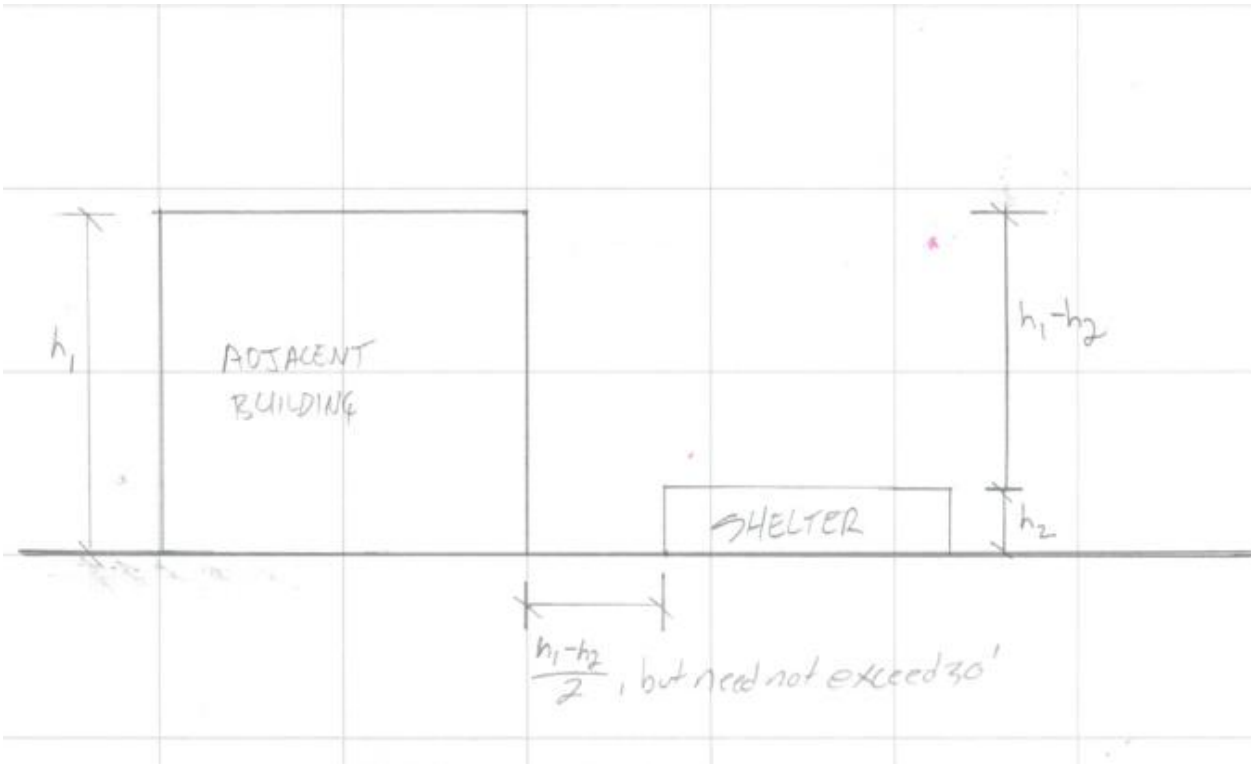
305.3 Laydown and falling debris hazards. ~~Lay down, rollover and collapse hazards shall be considered by the design professional when determining the location of shelters on the site.~~ Where the roof of the storm shelter is within the laydown radius of a *laydown hazard* or the fall radius of a *falling debris hazard*, the storm shelter shall be designed to resist the impact loads from such hazards.

305.3.1 Laydown radius. The laydown radius is a horizontal distance equal to the height of the *laydown hazard*.

305.3.2 Fall radius. The fall radius is a horizontal distance equal to half the difference between the height of the *falling debris hazard* and the height of the roof of the storm shelter but need not exceed 30 ft (9.1 m).

305.3.3 Impact loads. Impact loads from laydown and falling debris hazards shall be determined using a minimum impact factor of 2.0 times the estimated weight of the debris hazard. Each laydown and falling debris hazard load shall be considered one at a time, applied simultaneously with the uniform live loads on the roof of the shelter in accordance with Section 303.2.

Committee Reason: Provide load provisions for laydown, falling debris and vehicle/wheel loads.



IS-STM 03-12-18

IS-STM 03-12-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	12	3	0	0	2
Staff Notes: CCC Item					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Manley Vote:		x		

Your comment/reason: Section 305.3.1 and Section 305.3.2 really function as definitions and not mandatory requirements. Either relocate these to Chapter 2 or modify them to be in mandatory language.

Revise as follows:

HAZARDS.

Coastal. See definition for Coastal High-Hazard Area.

Falling debris. Exterior components, cladding, and appurtenances, such as parapet walls, masonry cladding, or rooftop equipment, that could fall onto the roof of a storm shelter from wind damage to adjacent, taller buildings or taller sections of a host building.

Flood. See definition for Flood Hazard Area.

Laydown. Nearby structures other than buildings, such as self-supporting towers, poles or large trees, that could fall onto the roof of a storm shelter.

RADIUS

Laydown. A horizontal distance equal to the height of the *laydown hazard*.
Fall. A horizontal distance equal to half the difference between the height of the *falling debris hazard* and the height of the roof of the storm shelter but need not exceed 30 ft (9.1 m).

305.3 Laydown and falling debris hazards. Where the roof of the *storm shelter* is within *the laydown radius* of a *laydown hazard* or the *fall radius* of a *falling debris hazard*, the storm shelter shall be designed to resist the impact loads from such hazards.

~~**305.3.1 Laydown radius**. The laydown radius is a horizontal distance equal to the height of the *laydown hazard*.~~

~~**305.3.2 Fall radius.** The fall radius is a horizontal distance equal to half the difference between the height of the *falling debris hazard* and the height of the roof of the storm shelter but need not exceed 30 ft (9.1 m).~~

~~**305.3.3**~~ **305.3.1 Impact loads.** Impact loads from *laydown* and *falling debris hazards* shall be determined using a minimum impact factor of 2.0 times the estimated weight of the debris hazard. Each *laydown and falling debris hazard* load shall be considered one at a time, applied simultaneously with the uniform live loads on the roof of the *storm shelter* in accordance with Section 303.2.

-OR-

305.3 Laydown and falling debris hazards. Where the roof of the *storm shelter* is within the laydown radius of a *laydown hazard* or the fall radius of a *falling debris hazard*, the *storm shelter* shall be designed to resist the impact loads from such hazards.

305.3.1 Laydown radius. The laydown radius ~~is~~ shall be a horizontal distance equal to the height of the *laydown hazard*.

305.3.2 Fall radius. The fall radius ~~is~~ shall be a horizontal distance equal to half the difference between the height of the *falling debris hazard* and the height of the roof of the *storm shelter* but need not exceed 30 ft (9.1 m).

305.3.3 Impact loads. Impact loads from *laydown* and *falling debris hazards* shall be determined using a minimum impact factor of 2.0 times the estimated weight of the debris hazard. Each *laydown* and *falling debris hazard* load shall be considered one at a time, applied simultaneously with the uniform live loads on the roof of the shelter in accordance with Section 303.2.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Reoper Vote:		**x**		

Your comment/reason: Definitions for *Laydown Radius* and *Fall Radius* should be moved to Ch. 2

No suggested revisions

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:		**x**		

Your comment/reason: Section 202-Definition "ROLL OVER HAZARDS. See "Hazards, Rollover." Needs to be omitted since this has been remove by this proposal.

Staff note: see CCC item for this proposal

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Curtis PC		**x**		

Your comment/reason: Reason: The previous version of ICC 500 was simple under 305.3. It simply stated that "Lay down, rollover and collapse hazards shall be considered by the design professional when determining the location of the shelter on the site." Existing buildings come in a variety of construction materials as well as age of construction that may or may not be conducive to handling the design wind speeds of a storm shelter. It seems that we are not considering the protection of the life, safety, health and welfare of the public if we do not at least give consideration for the building collapse. An example might be an old turn of the 1900's multiwythe brick building which from my experience is not well connected from foundation to roof and would likely collapse. Similarly tilt-wall buildings as recent as the Dallas tornado earlier this year has been documented to have walls lay down and collapse after the roof diaphragm is destroyed. Other multi-story concrete or heavy steel frames may well not collapse. By changing this definition, however, we have taken this consideration out of the code and indirectly stated that if it is a building we don't need to consider it as a laydown threat.

Email to proponent from staff – Original proposal was to have the exception on the definition. Definitions cannot have exceptions. If the definition is changed to include buildings, the exception must be applied to Section 305.3.

2nd email -I am OK with making the changes you have stipulated for the exception. We cannot lose the ability to consider building collapse as a real and very distinct possibility. We already know that the 100 PSF roof live load is really tied to debris, much of which is from wood framed buildings. The proposed change would give no consideration for building collapse onto a storm shelter. I had this specific case as a peer reviewer…3 story wood framed building on two sides and directly adjacent to a one story shelter also acting as a retirement lounge. As I mentioned, tilt-wall construction is notorious for significant collapse models where the roof diaphragm is sucked off and the walls lay down. Metal buildings are another class of buildings that seem to have collapse involvement at a discrete frame line. We also worked on a project in El Reno after the 2013 tornado and an older precast buildings failed in that storm. The long span double tees failed in uplift because there were no strands to resist the high winds in uplift. It split the double tees and when it set back down, the tees failed in the center and collapsed to the ground. I am not having to think too hard to understand there is a public safety consideration for placing a storm shelter inside or adjacent to an existing building.

Based on the BARA studies we have performed, there can be reasonable assumptions for multi-story concrete and heavy steel frame buildings not collapsing based on well over 100 tornado sites being evaluated. If that cannot be made, perhaps justification can be made for an existing building being able to yield but not collapse. We did that on a recent project that had a 1.5 story shelter built in the shadows of a 12 story dormitory building. In my mind you cannot place a shelter in the fall zone of a 12 story building if it cannot be proved to remain standing.

Revise as follows:

HAZARDS

Laydown. Nearby structures ~~other than buildings~~ such as buildings, self-supporting towers, poles or large trees that could fall onto the roof of a storm shelter.

305.3 Laydown and falling debris hazards. Where the roof of the storm shelter is within the laydown

radius of a *laydown hazard* or the fall radius of a *falling debris hazard*, the storm shelter shall be designed to resist the impact loads from such hazards.

Exception: Buildings can be excluded where it can be documented to rule out a collapse of said building at design wind speed.

Staff note: Alternative wording.

Exception: Adjacent buildings constructed to meet the design wind speeds are not considered a laydown or falling debris hazard.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason: What if a portion of host building (beams, etc.) are simply above and subject to falling on (impacting) the shelter? Should this include wind and impact loads?

No revisions suggested:

304.9 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 the maximum force that could be transmitted to the *storm shelter* equal to the ultimate failure strength of the connection or element being connected, whichever is lower, concurrent with the other wind loads on the *storm shelter* required by Chapter 3.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
CCC item:				

Your comment/reason:

~~**COLLAPSE HAZARDS.** See "Hazards, Collapse."~~

FALLING DEBRIS HAZARDS. See Hazards, Falling debris."

HAZARDS.
Coastal. See definition for Coastal High-Hazard Area.
Falling debris. Exterior components, cladding, and appurtenances, such as parapet walls, masonry cladding, or rooftop equipment, that could fall onto the roof of a storm shelter from wind damage to adjacent, taller buildings or taller sections of a host building.
Flood. See definition for Flood Hazard Area.
Laydown. Nearby structures other than buildings, such as self-supporting towers, poles or large trees, that could fall onto the roof of a storm shelter.

LAYDOWN HAZARDS. See "Hazards, Laydown."

~~**ROLLOVER HAZARDS.** See "Hazards, Rollover."~~

IS-STM 03-14-18
ICC 500 Section 306

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

SECTION 306

SHELTER ENVELOPE COMPONENT ~~DESIGN AND~~ TESTING

Reason: Clarifying title of Section 306 will minimize potential confusion over use of the term 'components' which is also used in the standard to refer to components of support systems and in the context of "components and cladding". As noted in Section 306 charging language, the section specifically addresses testing requirements for 'shelter envelope components" which include roof and wall assemblies, opening protective systems, and impact protective systems (subset of opening protective systems that may not require pressure testing). The revised title better captures the section scope and emphasizes that all shelter envelope components must be tested in accordance with Section 306 requirements. Additionally, with the exception of alternate anchorage provisions (Section 306.6), Section 306 only addresses testing requirements, so it's recommended that 'Design and' be removed from the title section to further clarify scope.

Committee Action: As Modified (9-0) 1 Abstain

Replace with the following:

SHELTER ENVELOPE COMPONENT ~~DESIGN AND~~ TESTING AND DESIGN

Committee Reason: Add design back into the title, 306 includes design requirements. New title is more specific.

IS-STM 03-14-18

IS-STM 03-14-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	0
Staff Notes: These ACI documents are not used in the IBC and have not been reviewed for compliance with ICC rules for referenced standards.					

	Committee action: Approval as Modified

	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Szoke Vote:		X		

Your comment/reason: Proper performance of post-installed anchors is essential to assure proper overall structural performance. Problems with the performance of post-installed anchors has resulted in new anchor requirements in ACI 318 *Building Code Requirements for Structural Concrete*. It is noteworthy that the industry trend to to move away from wet-set anchors in favor of the use of post installed anchors. Since the performance of the structure during event conditions is reliant on the connections of structural elements, especially those to foundation elements, it is important to ensure that post-installed anchors satisfy the necessary qualification. This public comment adds the necessary reference to assure proper qualification for anchoring structural elements to concrete.

Add new section and references as follows:

306.5 Anchors to foundations. For *community storm shelters*, post-installed anchors connecting structural elements to concrete foundation systems shall comply with the following:

306.5.1 Mechanical anchors. Post-installed mechanical anchors shall be in accordance with ACI 355.2.

306.5.2 Adhesive anchors. Post-installed adhesive anchors shall be in accordance with ACI 355.4.

Add new references to Chapter 9 and correct ACI address:

ACI
American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331

Standard Reference number	Title	Referenced in code section number
355.2	Qualification of Post-Installed Mechanical Anchors in Concrete	306.5.1
355.4	Qualification of Post-Installed Adhesive Anchors in Concrete	306.5.2

IS-STM 03-15-18
ICC 500 Sections 306.3, 306.4, 306.5, 306.6, 306.7, 306.8, 309.1

Proponent: Marc Levitan, representing ICC 500 Committee

Revise as follows:

SECTION 306
COMPONENT DESIGN AND TESTING

306.1 Shelters meeting tornado impact test requirements. Shelter envelope components meeting missile impact test requirements for tornado shelters shall be considered acceptable for hurricane shelters provided they meet structural design load requirements for hurricane shelters.

306.2 Roof and wall assemblies. Roof and wall assemblies shall meet the missile impact criteria of Section 305.1, and the pressure requirements of Section 304.1.

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

306.3.1 Testing of shelter door assemblies. Door assemblies for use in the shelter envelope shall be tested in accordance with missile impact and pressure test procedures described in Chapter 8.

306.3.1.1 ~~306.7~~ Door undercut. Door or shutter assemblies for use in the shelter envelope with a threshold at the level of exit discharge shall be limited to a 3/4-inch (19.1 mm) maximum undercut. A weather seal at the door undercut where doors are exposed to weather shall be provided.

306.3.2 Testing of window assemblies and other glazed openings….
306.3.2.1 Window and skylight assemblies for tornado shelters…..
306.3.2.2 Window and skylight assemblies for hurricane shelters…..

306.3.3 ~~306.4~~ Testing of Impact-protective systems. Impact-protective systems shall be tested for missile impact in accordance with Chapter 8.

Exception: Nonoperable, permanently affixed shields or cowlings are excluded from pressure testing requirements of Section 806.5.

306.3.4 ~~306.5~~ Testing of Alcove or baffled entry systems. All protective elements of alcove or baffled entry systems shall be designed to meet the wind load requirements of Section 304 and the debris impact test requirements of Section 305. Where a door is employed as part of the protection in such an entry system, the door shall meet the debris impact test requirements of Section 804.9.7 and the pressure testing requirements of Sections 805 and 806.6. The enclosure classification for shelters with baffled or alcove entries shall be determined in accordance with Section 304.6.

Exception: When the entry system for a residential shelter is equipped with a door assembly that meets the pressure requirements of Section 304, the enclosure classification shall remain unchanged by the alcove or baffled entry system.

306.3.5 ~~306.6~~ Anchorage of doors, windows and ~~shutters~~ other impact-protective systems. Where anchorage of door assemblies, window assemblies or ~~shutter framing~~ other impact-protective systems to the shelter structure is required by means other than those provided in the manufacturer's listing or installation instructions in accordance with Section 107, alternate anchorage shall be designed for pull-out and shear and the anchor placement detailed in

accordance with accepted engineering practice. The alternate anchorage details and calculations shall be provided as part of the construction documents.

306.3.6 ~~306.8~~ Joints, gaps or voids in shelter envelope. Joints, gaps or voids in a shelter envelope that opens into the protected occupant area similar to masonry control joints, expansion joints, opening protective device shim spaces, air louver blades, grates, grilles, screens or precast panel joints shall be considered openings and shall be protected in accordance with Sections ~~306.3 and 306.4~~ 306.3.1, 306.3.2 or 306.3.3.

Exceptions:

1. Masonry control joints, masonry or concrete expansion joints or precast concrete panel joints 3/8-inch (9.5 mm) or less in width, sealed with joint material in accordance with TMS 602 for masonry or ASTM C920 for concrete.
2. Joints, gaps or voids that will not allow a direct debris path through the shelter envelope into the protected occupant area. Debris 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.

SECTION 309
PENETRATIONS OF STORM SHELTER ENVELOPE BY SYSTEMS AND UTILITIES

309.1 Penetrations of storm shelter envelope by mechanical, electrical and plumbing systems. 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^2) in area for rectangular penetrations or 2-1/16 inches (52.38 mm) in diameter, 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.

Reason: This is in the proposals as a result of the failed committee interpretation last round to Section 601. See IS-STM 03-12-18, 06-02-18, 06-03-18, 06-04-18.

This proposal is specifically dealing with opening protectives.
There are three concerns –

- There is no reference to door undercut from doors, or anchorage from any of the sections
- There is not consistent terminology between sections
- Section 309.1 sends you back to 306.3, openings, but the correct application may be 306.8 for pipes or other smaller penetrations such as electrical boxes. There is now way to get there is current text.

Making all opening protective requirements a subsection of 306.3 would provide a cohesive package for openings and allow MEP openings to use all options. Move door undercuts to the requirements for doors to keep requirements together for doors.

There remains the question for protection of MEP penetrations such as pipes or electrical boxes. It appears that larger duct openings would typically use some type of baffle entry system? What about the others? Could a pipe use TMS 602 or ASTM C920 for example? Is a pipe in a hole complying with 306.8 Exception 2?

Committee Action: Approved as submitted (9-0)

Committee Reason: Reorganization for clarification.

IS-STM 03-15-18

IS-STM 03-15-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	15	0	0	0	1
Staff Notes: Coordination may be required with the work/terminology on this section from Work Group 8.					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Holstein PC		x		

Your comment/reason: Reason: Section 306.4.1 addresses doors, and Section 306.4.2 addresses windows. Doors and windows are both impact protective systems, so Section 306.4.3 should address other impact protective systems.

Current language applies only to missile impact, but the exception is for pressure loading. Language should be added to include pressure loading in Section 306.4.3 or the exception cannot apply.

Per Section 805.5, shields and cowlings are still required to be designed to resist the design loads, they are not exempted from testing outright. The proposed language clarifies this requirement.

Revise as follows:

306.4.3 Testing of other *Impact-protective systems*. *Impact-protective systems* shall be tested for missile impact and pressure loading in accordance with Chapter 8.

Exception: Nonoperable, permanently affixed shields or cowlings are excluded from pressure testing requirements of Section 805.5 where designed to resist the applicable static and dynamic loads.

IS-STM 03-19-18
ICC 500 Section 306.8

Proponent: Jason Krohn, Precast/Prestressed Concrete Institute (PCI)

Revise as follows:

306.8 Joints, gaps or voids in shelter envelope. Joints, gaps or voids in a shelter envelope that opens into the protected occupant area similar to masonry control joints, expansion joints, opening protective device shim spaces, air louver blades, grates, grilles, screens or precast panel joints shall be considered openings and shall be protected in accordance with Sections 306.3 and 306.4.

Exceptions:

1. Masonry control joints, masonry or concrete expansion joints ~~or precast concrete panel joints~~ $^3/_8$-inch (9.5 mm) or less in width, sealed with joint material in accordance with TMS 602 for masonry or ASTM C920 for concrete.
2. Precast concrete panel joints in accordance with ASTM C920 shall be permitted to be a specified width of 3/4-inches where the manufacturer's installation instructions require larger joint widths.

3.~~2.~~ Joints, gaps or voids that will not allow a direct debris path through the shelter envelope into the protected occupant area. Debris 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.

Reason: Section 306.8, Exception 1 to ICC 500 permits joint widths in masonry, cast in place concrete and precast concrete panels to be 3/8-inches or less and meet ASTM C920 to comply with the standard. However, these provisions do not take into account physical features that make these three material systems different when constructing storm shelters. These differences are needed to allow for construction tolerances for the joint widths.

For example, TMS 602, Specifications for Masonry Structures identifies the dimensional tolerances needed for masonry construction joints. These tolerances, some of which can vary from -1/4 inch to + 3/8 inch, take into account manufacturing tolerances of the masonry units. Precast concrete panel joints also have dimensional tolerance provisions within ACI 318, Building Code Requirements For Structural Concrete, which are different from masonry. The allowable joint width should consider the material of choice in setting the joint dimensions in the exceptions to Section 306.8.

Further, for precast concrete joints there are some joint materials that meet ASTM C920 requirements but also have additional requirements from the manufacturer that the joint width be specified at 3/4-inches for proper installation and performance. This proposal will permit the use of these slightly wider joint widths where the manufacturers of approved joint material have installation instructions that require these larger joints.

Finally, the 3/4-inch dimension for precast concrete panels is likely to perform better than 3/4-inch joints permitted for the undercuts of storm shelter doors in Section 306.7. In the case of the precast concrete panels, the joints are filled with material that help resist the passage of storm debris whereas the undercut joint on a door does not exhibit the same resistance.

Staff note: By striking the concrete panels from Exception 1 and with the new language in Exception 2, there would be no information for concrete panels that did not meet Exception 2. In addition, the language could be read to that the ¾" is the only size permitted, and only when the manufacture wants something wider than ¾". Possible solution might be as follows:

2. Precast concrete panel joints shall be permitted to be 3/4-inches (19 mm) or less in width where sealed with joint material in accordance ASTM C920.

Committee Action: Approved as Modified (9-1)

Replace with the following:

306.8 Joints, gaps or voids in shelter envelope. Joints, gaps or voids in a shelter envelope that opens into the protected occupant area similar to masonry control joints, expansion joints, opening protective device shim spaces, air louver blades, grates, grilles, screens or precast panel joints shall be considered openings and shall be protected in accordance with Sections 306.3 and 306.4.

Exceptions:

1. Masonry control joints, masonry or concrete expansion joints ~~or precast concrete panel joints~~ $^3/_8$-inch (9.5 mm) or less in width, sealed with joint material in accordance with TMS 602 for masonry or ASTM C920 for concrete.
2. Precast concrete panel joints shall be permitted to be 3/4-inches (19 mm) or less ~~-~~in width where sealed with joint material in accordance ASTM C920.
3. ~~2.~~ Joints, gaps or voids that will not allow a direct debris path through the shelter envelope into the protected occupant area. Debris 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.

Committee Reason: : Justification provided for concrete panels. Revised language is better code language

IS-STM 03-19-18

		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**13**	**1**	**1**	**0**	**1**
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Ehrlich Vote:		**x**		

Your comment/reason: Editorial revision to align the language of Exception #1 and Exception #2:

Revise as follows:

306.4.6 Joints, gaps or voids in *storm shelter envelope*. Joints, gaps or voids in a *storm shelter*

envelope that opens into the *protected occupant area* similar to masonry control joints, expansion joints, opening protective device shim spaces, air louver blades, grates, grilles, screens or precast panel joints shall be considered openings and shall be protected in accordance with Sections 306.4.1, 306.4.2 or 306.4.3.

Exceptions:
1. Masonry control joints and~~,~~ masonry or concrete expansion joints 3/8-inch (9.5 mm) or less in width, sealed with joint material in accordance with TMS 602 for masonry or ASTM C920 for concrete.
2. Precast concrete panel joints ~~shall be permitted to be~~ 3/4-inches (19 mm) or less in width where sealed with joint material in accordance ASTM C920.
3. Joints, gaps or voids that will not allow a direct debris path through the *storm shelter envelope* into the *protected occupant area*. Debris particles 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.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:			**x**	

Your comment/reason: *The basis of this proposal is testing that was conducted on pre-cast concrete joints by TTU (test report attached) Contrary to statements by the proponent, 50% of the tested assemblies failed the test. This proposal moves the responsibility of protecting the joint from the precast concrete industry to another (unknowing) discipline i.e. the sealant industry. The test was conducted with new sealant, but no sealant manufacturer was listed. Not all sealants are the same and may react differently to the test. See attached testing report.*

Sealants age relatively quickly when exposed to the elements or in the harsh environment of a cavity created by veneer materials. Sealants need constant attention and regular replacement by the owner of the shelter as sealants will lose elasticity, adhesion, and/or split over time. Sealants located within cavities cannot be monitored. Sealants can begin to fail in a matter of 2-4 years after initial installation depending on the weather conditions which the joints are exposed. Freeze/thaw conditions which is common in a large portion of the 250 mph wind zone is extremely hard on these joints.

Per PCI industry standards, a specified ¾" joint has a tolerance allowing the wall joint to increase to 1-1/8" with standard spacing of 8'-10' around the entire perimeter of the storm shelter including the roof. This is 3x's the width of the allowable joints in exception 1 and more than 3x's the number of joints in masonry typically spaced at 24' center and masonry joints are not located on the roof. In the field, the same ¾" specified joint can exceed 2". Allowing precast concrete joint to be protected with sealants is not consistent with providing protection to any utility opening greater than 3.5 sq in or 2 1/16" in diameter OR being concerned with debris particles coming through a louver as submitted per exception 3.

There are effective, PERMANENT methods to provide protection of these joints by the precast industry. They include joint off-set, interior plating of the joint, and installation of a continuous vertical steel rod (slug) welded in the joint.

If this proposal remains in the code, these joints will become the weakest link in precast storm shelters over taking doors.

Recommend omitting exception 2 and leave exception 1 as originally written.

Request Disapproval. Revise as follows:

306.4.6 Joints, gaps or voids in *storm shelter envelope*. Joints, gaps or voids in a *storm shelter envelope* that opens into the protected occupant area similar to masonry control joints, expansion joints, opening protective device shim spaces, air louver blades, grates, grilles, screens or precast panel joints

shall be considered openings and shall be protected in accordance with Sections 306.4.1, 306.4.2 or 306.4.3.

Exceptions:

1. Masonry control joints, masonry or concrete expansion joints or precast concrete panel joints 3/8-inch (9.5 mm) or less in width, sealed with joint material in accordance with TMS 602 for masonry or ASTM C920 for concrete.

~~2. Precast concrete panel joints shall be permitted to be 3/4-inches (19 mm) or less in width where sealed with joint material in accordance ASTM C920.~~

~~3.~~2. Joints, gaps or voids that will not allow a direct debris path through the storm shelter envelope into the protected occupant area. Debris particles 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.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Curtis PC			**x**	

Your comment/reason: It is my understand that previous editions of ICC 500 considered a maximum joint width of 3/8" nominal to reduce the amount of possible opening that could allow small debris to enter. Considering that the maximum joint width could be 1-1/8" on precast, this seems like a very significant area for wind pressure breaching a sealant joint. Also, no-one has addressed how sealant material will hold up under long term use and how can this item easily be maintained or even checked. Recommend keeping the verbiage as stated from the previous code edition.

Request Disapproval. Revise as follows:

306.4.6 Joints, gaps or voids in *storm shelter envelope*. Joints, gaps or voids in a *storm shelter envelope* that opens into the protected occupant area similar to masonry control joints, expansion joints, opening protective device shim spaces, air louver blades, grates, grilles, screens or precast panel joints shall be considered openings and shall be protected in accordance with Sections 306.4.1, 306.4.2 or 306.4.3.

Exceptions:

1. Masonry control joints, masonry or concrete expansion joints or precast concrete panel joints 3/8-inch (9.5 mm) or less in width, sealed with joint material in accordance with TMS 602 for masonry or ASTM C920 for concrete.

~~2. Precast concrete panel joints shall be permitted to be 3/4-inches (19 mm) or less in width where sealed with joint material in accordance ASTM C920.~~

~~3.~~2. Joints, gaps or voids that will not allow a direct debris path through the storm shelter envelope into the protected occupant area. Debris particles 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.

IS-STM 03-22-18
ICC 500 Section 307.2, 702.4(New), 703.9(New)

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

~~**307.2 Electrical grounding of shelters.** Exposed metal interior surfaces of shelters that are electrically grounded and electrical fixtures within shelters shall be grounded only to the host building external grounding system.~~

702.4 Electrical bonding of tornado shelters. Exposed metal surfaces within tornado shelters shall be electrically bonded and hall be electrically connected to the tornado shelter's grounding electrode system where such grounded electrode systems exists.

703.9 Electrical bonding of hurricane shelters. Exposed metal surfaces within hurricane shelters shall be electrically bonded and shall be electrically connected to the hurricane shelter's grounding electrode system where such grounded electrode systems exists.

Reason: This proposed standard change seeks to accomplish the following three objectives:
(1) Move existing electrical grounding requirements from Chapter 3 (Structural Design Criteria) to Chapter 7 (Shelter Essential Features and Accessories), because requirements related to weather protection align better with Chapter 7 scope.
(2) Reduce shock hazards to shelter occupants by requiring that all exposed metal surfaces within shelters be electrically bonded together. Electrical bonding reduces the voltage difference between metal surfaces that can result from electrical failures and lightning strikes. It also requires that the metal surfaces be electrically connected to the shelter's grounding electrode system when one exists.
(3) Correct improper terminology (e.g., replace 'grounded' with 'bonded') present in the existing standard.

Staff note: If a storm shelter is a bathroom, would interior surface include walls, shutters, doors, toilet partitions? Something that wrapped from outside to in like metal door and window frames? Or would surface also include things like faucets, drain pipes, hand dryers, set in towel dispensers/garbage cans, metal door thresholds, metal toilets?

Committee Action: As Modified (7-0 – meeting, 11-0 electronic vote)

Replace with the following:

~~**307.2 Electrical grounding of shelters.** Exposed metal interior surfaces of shelters that are electrically grounded and electrical fixtures within shelters shall be grounded only to the host building external grounding system.~~

702.5 Electrical grounding and bonding of tornado shelters. Exposed metal surfaces within tornado shelters shall be electrically bonded and grounded where required by Article 250 of NFPA 70 or by the authority having jurisdiction.

703.9 Electrical grounding and bonding of hurricane shelters. Exposed metal surfaces within hurricane shelters shall be electrically bonded and grounded where required by Article 250 of NFPA 70 or by the authority having jurisdiction.

Chapter 9 Referenced Standards

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

70—17: National Electrical Code

Committee Reason: This provision should not be in the structural provisions, it should be in Chapter 7. This is coordinated with the electrical code requirements. The commentary should include guidance for shelters without electrical power.

IS-STM 03-22-18

		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**13**	**2**	**0**	**0**	**0**

Staff notes:
Errata: Staff picked up original proposed text instead of as modified. Section 702.5 in tornado shelter is correct. For hurricane shelters, the section should have been shown as follows:

703.7 Electrical grounding and bonding of hurricane shelters. Exposed metal surfaces within hurricane shelters shall be electrically bonded and grounded where required by Article 250 of NFPA 70 or by the authority having jurisdiction.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:		**x**		

Your comment/reason: *702.4, 703.9-Is the intent of the sections to include all metal surfaces within a shelter like HM and Aluminum doors, HM frames, aluminum windows, toilet partitions, fire extinguisher cabinets, etc. to be grounded or is the intent for the exterior metal wall and roof surfaces of the shelter to be grounded? As written, ANY metal surface would have to be grounded.*

No suggested revisions

702.5 Electrical grounding and bonding of *tornado shelters*. Exposed metal surfaces within *tornado shelters* shall be electrically bonded and grounded where required by Article 250 of NFPA 70 or by the *authority having jurisdiction*.

703.7 Electrical grounding and bonding of *hurricane shelters*. Exposed metal surfaces within *hurricane shelters* shall be electrically bonded and grounded where required by Article 250 of NFPA 70 or by the authority having jurisdiction.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: 703.7 is very different from what the public input agenda says we voted on.

Staff note: See errata in the staff notes for IS-STM 03-22-18

IS-STM 03-23-18
ICC 500 Section 308.1.1.1

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

308.1.1.1 Slabs-on-grade. New or existing slabs-on grade shall be designed or evaluated for the applicable loads in accordance with Section 301; however, the minimum thickness shall be 31/2 inches (88.9 mm) and the minimum steel reinforcement for slabs-on-grade resisting forces on the storm shelter shall be 6 × 6 – W1.4 × W1.4 welded wire reinforcement over the required area of slab or No. 4 bars, at a maximum spacing of 18 inches (457 mm) on center, in two perpendicular directions.

Exception: Concrete and concrete masonry storm shelters shall be permitted to be constructed within existing one- and 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 not exceed 2000 psf (95.8 kN/m^2) for design loading conditions other than design storm shelter events and 3000 psf (143.7 kN/m^2) 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.
3. Reinforcing in the slab-on-grade shall not be required where the dead load of the slab is not required to resist overturning.

Reason: The change clarifies that existing slabs-on-grade should be evaluated to verify that they are able to resist the applicable loads since they are past the design stage and new slabs-on-grade should be designed for all applicable loads.

Committee Action: As Modified (11-1)

Replace with the following:

308.1.1.1 Slabs-on-grade. New ~~or existing~~ slabs-on grade shall be designed ~~for~~ to resist the applicable loads in accordance with Section 301. Existing slabs-on grade shall be evaluated to verify that such slabs are able to resist the applicable loads in accordance with Section 301.~~; however,~~ The minimum thickness of the slabs-on-grade shall be 3-1/2 inches (88.9 mm) and the minimum steel reinforcement for slabs-on-grade resisting forces on the storm shelter shall be 6 × 6 – W1.4 × W1.4 welded wire reinforcement over the required area of slab or No. 4 bars, at a maximum spacing of 18 inches (457 mm) on center, in two perpendicular directions.

Exception: (no change to text)

Committee Reason: Clarifies existing language.

IS-STM 03-23-18

IS-STM 03-23-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	15	0	0	0	1
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Holstein PC		x		

Your comment/reason: Wall and roof assemblies are not defined as impact protective systems, therefore "other" should be removed from the above sentence. The list should include wall assemblies, roof assemblies, and all impact protective systems.

Revise as follows:

802.1 Test assembly. 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 assemblies, roof assemblies or ~~other~~ impact protective systems shall be allowed in lieu of testing entire *storm shelters*. Where failure of framing members controls the impact performance, wall and roof assemblies subjected to debris impact-testing shall be a minimum of 4 feet (1219 mm) wide and the full length of the span of the wall or roof section from support to support. Where failure of framing members has been shown through testing to not control the impact performance, wall and roof sections subjected to debris impact testing shall be a minimum of 4 feet (1219 mm) wide by 4 feet (1219 mm) high unless dimensions of the actual assembly are less than these dimensions.

Impact-protective systems shall be impact tested and cyclic tested where applicable, at the maximum and minimum size listed for use. Static pressure testing shall be conducted on the maximum size listed for use. Operable door assemblies and window assemblies shall be tested for the conditions of swing and latching including inward or outward swing separately as specified for use of the product. Impact-protective systems shall be static pressure tested in both directions unless a clear worst-case direction is determined by the *test laboratory*. Paired doors and their latching hardware shall be tested independently from single doors. The *specimen* shall consist of the entire assembled unit and shall, where practical, be mounted as it will be installed in a *storm shelter*, and shall contain all devices used to resist wind forces and wind-borne debris. Where it is not practical to install for testing door assemblies and window assemblies as it will be mounted in a *storm shelter*, then the unit or assembly shall be mounted in a test buck to connect the *specimen* to the test frame, stand or *test chamber*. Details of the mounting shall be described in the test report.

IS-STM 03-24-18
ICC 500 Section 309.1

Proponent: Benchmark Harris, The National Storm Shelter Association (NSSA) Design Practices Committee

Revise as follows:

309.1 Penetration of storm shelter envelope by mechanical, electrical and plumbing systems. Penetrations through the storm shelter envelope of mechanical, electrical and plumbing systems, including piping and utility lines, larger than 3½ square inches (2258 mm^2) in area for rectangular penetrations or ~~2-1/16~~ 2-1/2 inches (~~52.38~~ 63.5 mm) in diameter, 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.

Reason:

The International Plumbing Code requires that the inside diameter of a vent pipe be a minimum of one-half the inside diameter of the related sanitary sewer lines. It is common for a 4" inside diameter pipe to be used for sanitary sewer lines, which requires a 2" inside diameter vent pipe. A PVC pipe with an inside diameter of 2" has an outside diameter that is slightly larger than a 2 1/16" diameter, which means a baffling system is required just for this one pipe that is often in a location by itself over the required restrooms. To avoid an expensive baffling system, a studor-type filtered vent could be installed; however, it is better practice for vent pipes to extend through a roof to expel noxious fumes rather than stop the vent inside a shelter, below the roof, and have a studor- type filtered vent that would need to be properly maintained or the occupants may become sick over time. There are other types of materials with a thinner wall thickness, such as copper, but even copper has an outside diameter greater than 2 1/16". One of the most common types of debris is a wood stud, which should still be significantly retarded if the hole for the penetration is not more than 2 1/2" in diameter. Therefore, allowing a 2 14" diameter penetration without baffling is not sacrificing any significant amount of debris resistance while addressing a common plumbing dilemma.

Committee Action: As Submitted (11-1)

Committee Reason: The hole would allow for standard material sizes.

IS-STM 03-24-18

IS-STM 03-24-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment

Report	14	1	0	0	0
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Schultz Vote:		x		

Your comment/reason: *The original 2-1/16" diameter was derived from the close equivalent of 3-1/2 square inches. The proposed change to 2-1/2" diameter is equal to 4.9 square inches which is 40% larger than the 3 1/2 square inches. Should the 3 1/2 square inches be reconsidered?*

Revise as follows:

308.1 Penetrations of *storm shelter envelope* by mechanical, electrical and plumbing systems. 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^2) in area for rectangular penetrations or 2-1/16 ~~2-1/2~~ inches (52.38 ~~63.5~~ mm)in diameter for circular penetrations, 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 *storm 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 *applicable codes* and standards governing such utility lines.

IS-STM 03-27-18
ICC 500 Sections 308

Proponent: ICC 500

Revise as follows:

308.1 Connections of storm shelters to foundations or slabs. Storm shelters shall be designed to resist all loads specified in Chapter 3 and to transfer the resultant forces into the ground with a foundation or slab-on-ground.

308.1.1 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 storm shelters are anchored to foundations or slabs-on-~~grade~~ ground 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.

308.1.2 ~~308.1.1.3~~ Elevated *storm shelter* foundations. Where *storm shelters* are constructed with the top of the supporting foundation structure located at an elevation higher than the surrounding finished grade level, the structural stability of the *storm shelter* and elevated supporting foundation structure shall be computed assuming that both are fully exposed to the *storm shelter* design wind and flood forces. Where applicable, and in accordance with ASCE 7, the impacts of wind-borne and flood-borne debris on stability of the foundation shall be considered.

308.2 Slabs on ground within a storm shelter. Slabs-on-ground within a storm shelter not required to transfer wind forces acting on the storm shelter to the ground or to a foundation supporting the storm shelter shall be designed in accordance with the applicable building code.

308.3 Slabs-on-ground acting as ballast. Slabs-on-ground acting as ballast only shall be designed or evaluated for the applicable loads in accordance with Section 301 and comply with the following:

1. Slabs-on-ground shall be a minimum 3-1/2 inches (88.9 mm) in thickness
2. Slabs-on-ground shall have a minimum of 6 x 6 W1.4 X W1.4 welded wire reinforcement or equivalent area of other steel reinforcement in each of two perpendicular directions.

308.4 Existing slabs-on-ground supporting storm shelters. Replacement or strengthening of existing slabs-on-ground or construction or a foundation where a storm shelter is to be installed shall not be required where all of the following conditions apply:

1. Single story community storm shelters with a footprint of 64 ft^2 or less or residential shelters.
2. The storm shelter is constructed out of concrete or concrete masonry**.**
3. Calculated soil pressure under the slabs-on-ground supporting the storm shelter walls does not exceed 2000 psf (95.8 kN/m2) for design loading conditions other than design storm shelter events and 3000 psf (143.7 kN/m2) for design storm shelter events.

4. The storm shelter is anchored at a minimum to the slab-on-ground at each corner of the structure and on each side of door openings in the shelter envelope.

308.5 ~~308.1.1.2~~Joints in concrete slabs-on-ground. Design calculations for concrete slabs-on-ground supporting storm shelters shall include the effect of expansion joints, contraction joints or construction joints where such slabs-on-ground are utilized to resist ~~tensile and shear~~ loads from the supported storm shelters.

308.6 Slabs-on-ground. Slabs-on-ground supporting only a storm shelter and transferring wind forces to the ground shall be designed or evaluated for the applicable loads in accordance with Section 301.

~~**308.1.1.1 Slabs-on-grade.** New or existing slabs-on grade shall be designed for to resist the applicable loads in accordance with Section 301. however, The minimum thickness shall be 3-1/2 inches (88.9 mm) and the minimum steel reinforcement for slabs-on-grade resisting forces on the *storm shelter* shall be 6 × 6 – W1.4 × W1.4 welded wire reinforcement over the required area of slab or No. 4 bars, at a maximum spacing of 18 inches (457 mm) on center, in two perpendicular directions.~~

~~**Exception:** Concrete and concrete masonry *storm shelters* shall be permitted to be constructed within existing one- and 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 not exceed 2000 psf (95.8 kN/m^2) for design loading conditions other than design *storm shelter* events and 3000 psf (143.7 kN/m^2) 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.~~
~~3. Reinforcing in the slab-on-grade shall not be required where the dead load of the slab is not required to resist overturning.~~

Reason: This is to address a question about if a slab inside of a shelter foundation is required to provide the same reinforcement as a slab that supports a shelter.

Supporting information, excerpts from ACI 332
ACI 332
10.6—Reinforcement
10.6.1 *Steel reinforcement*—Reinforcement shall consist of deformed bars or welded wire reinforcement conforming to 4.2.1 or 4.2.2 and shall be placed and maintained in the upper 2/3 of the slab depth with a minimum cover of 3/4 in. for interior conditions and 1-1/2 in. for exterior conditions. Reinforcement shall be supported in a manner that maintains its position during concrete placement.
10.6.2 *Minimum steel reinforcement based on joint spacing*—For crack-width control, provide contraction joints in accordance with 10.5.2, or a minimum area of reinforcement in both directions. The minimum area of reinforcement shall be equal to 0.5 percent times the slab cross-sectional area for joint spacing exceeding values in Table 10.5.2.

4.2—Reinforcement
4.2.1 *Deformed reinforcement*—Deformed steel reinforcing bars shall conform to ASTM A615/A615M, A706/ A706M, or A996/A996M. The yield strength of reinforcement shall be at least 40,000 psi.
4.2.2 *Welded wire reinforcement*
4.2.2.1 Welded plain wire reinforcement, designated by the letter W, shall conform to ASTM A1064/A1064M.
4.2.2.2 Welded deformed wire reinforcement, designated by the letter D, shall conform to ASTM A1064/A1064M.
4.2.3 *Prestressing steel*—Prestressing steel strand shall conform to ASTM A416/A416M.

4.2.4 *Surface conditions of reinforcement*—At the time concrete is placed, deformed bar and welded wire reinforcement shall be free of materials deleterious to development of bond strength between the reinforcement and the concrete.
4.2.5 *Fiber reinforcement*—Synthetic macrofiber and synthetic microfiber shall conform to ASTM C1116/C1116M.

Committee Action: Approved as Modified (8-0)

Replace proposal with the following:

308.1 Connections of storm shelters to foundation~~s or slabs~~ systems. Storm shelters shall be designed to resist all loads specified in Chapter 3 and to transfer the resultant forces into the ground with a type of foundation system.

308.1.1 Calculation of resistance. Structural stability of storm shelters shall be determined by engineering calculations for design wind ~~pressures~~ loads determined in accordance with Section 304. Where storm shelters are anchored to foundation~~s~~ systems ~~or slabs-on-grade whose~~ and such top surfaces ~~extending~~ extend outward from the storm shelter walls are at grade, the top surfaces of the foundation~~s~~ system ~~or slabs~~ shall not be considered to have wind uplift forces acting on them.

308.1.2 ~~308.1.1.3~~ Elevated *storm shelter* foundations systems. Where *storm shelters* are constructed with the top of the supporting foundation systems ~~structure~~ located at an elevation higher than the surrounding finished grade level, the structural stability of the *storm shelter* and elevated supporting foundation systems ~~structure~~ shall be computed assuming that both are fully exposed to the *storm shelter* design wind and flood ~~forces~~ loads. Where applicable, and in accordance with ASCE 7, the impacts of wind-borne and flood-borne debris on stability of the foundation systems shall be considered.

308.2 Slabs-on-ground. Where slabs-on-ground are serving as part of the foundation system for the storm shelter, the slabs-on-ground shall be designed in accordance with ACI 318 to resist all loads specified in Chapter 3 and to transfer the resultant forces into the ground.

Exception: Slabs-on-ground within a storm shelter not utilized to transfer wind forces acting on the storm shelter to the ground or to a foundation system supporting the storm shelter shall be designed in accordance with the applicable code.

308.2.1 ~~308.1.1.2~~ Joints in concrete slabs-on-ground ~~grade~~. Design calculations for concrete slabs-on-ground ~~grade supporting storm shelters~~ shall include the effect of expansion joints, contraction joints or construction joints where such slabs-on- ground ~~grade~~ are utilized to resist ~~tensile and shear~~ loads from the supported storm shelters.

308.3 Existing slabs-on-ground supporting storm shelters. Replacement or strengthening of existing slabs-on-ground where a storm shelter is to be installed shall not be required where all of the following conditions apply:

1. Community storm shelters that are a single story in height with a footprint of 64 ft^2 (5.95 m^2) or less or residential storm shelters.
2. The storm shelter are constructed out of concrete or concrete masonry.

3. Calculated soil pressure under the slabs-on-ground supporting the storm shelter walls does not exceed 2000 psf (95.8 kN/m^2) for design loading conditions other than design storm shelter events and 3000 psf (143.7 kN/m^2) for design storm shelter events.
4. The storm shelter is anchored at a minimum to the slab-on-ground at each corner of the structure and on each side of door openings in the shelter envelope.

~~**308.1.1.1 Slabs-on-grade.** New or existing slabs-on grade shall be designed for t the applicable loads in accordance with Section 301. however, The minimum thickness shall be 3-1/2 inches (88.9 mm) and the minimum steel reinforcement for slabs-on-grade resisting forces on the *storm shelter* shall be 6 × 6 – W1.4 × W1.4 welded wire reinforcement over the required area of slab or No. 4 bars, at a maximum spacing of 18 inches (457 mm) on center, in two perpendicular directions.~~

~~**Exception:** Concrete and concrete masonry *storm shelters* shall be permitted to be constructed within existing one- and 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 not exceed 2000 psf (95.8 kN/m^2) for design loading conditions other than design *storm shelter* events and 3000 psf (143.7 kN/m^2) 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.~~
3. ~~Reinforcing in the slab-on-grade shall not be required where the dead load of the slab is not required to resist overturning.~~

Chapter 9
ACI 318-19: Building Code Requirements for Structural Concrete

Committee Reason: This is to address a question about if a slab inside of a shelter foundation is required to provide the same reinforcement as a slab that supports a shelter. Add ACI 318 for slab design. There is not longer a need for a minimum slab or reinforcement – that is a function of the design and loads to transfer.

IS-STM 03-27-18

		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**11**	**4**	**0**	**0**	**0**
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Ehrlich Vote:		**x**		

Your comment/reason: The "with a type of foundation system" is awkward and is revised to provide improved load path and foundation design language consistent with IRC R301.1 and R401.2. A reference to ACI 332 *Code Requirements for Residential Concrete* for design of slabs-on-ground supporting residential storm shelters is added as the new edition of ACI 332 has a chapter on the design of structural concrete that can be as an alternative to the prescriptive provisions of ACI 332 for slabs-pn-ground, for dwellings falling within the scope of ACI 332.

Revise as follows:

307.1 Connections of storm shelters to foundation systems. Storm shelters shall be designed to resist all loads specified in Chapter 3 and to transfer the resultant forces from their point of origin through the structure to the ~~with a type of~~ foundation system. Foundations shall be designed to transmit the resulting loads to the supporting soil.

307.2 Slabs-on-ground. Where slabs-on-ground are serving as part of the foundation system for the storm shelter, the slabs-on-ground shall be designed in accordance with ACI 318 to resist all loads specified in Chapter 3 and to transfer the resultant forces into the ground.

Exceptions:

1. Slabs-on-ground within a storm shelter not utilized to transfer wind forces acting on the storm shelter to the ground or to a foundation system supporting the storm shelter shall be designed in accordance with the applicable building code.
2. Slabs-on-ground within a one- or two-family dwelling and supporting a *residential storm shelter* shall be designed in accordance with ACI 318 or ACI 332.

Chapter 9 References

ACI

318—19 Building Code Requirements for Structural Concrete

332—19 Residential Code Requirements for Structural Concrete

Staff Note: ACI 322 is currently referenced in the IRC.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Levitan Vote:		**x**		

Your comment/reason:

a. Awkward wording in 307.1. Suggest revise as shown

Revise as follows:

> **307.1 Connections of storm shelters to foundations systems.** Storm shelters shall be designed to resist all loads specified in Chapter 3 and to transfer the resultant forces into the ground ~~with a type of~~ through the foundation system.

b.In 307.3, item 3, the term 'design storm shelter event' is used twice. Change to 'design storm event' as used in 701.1 for consistency (and the 701.1 term is more appropriate)

Revise as follows:

307.3 Existing slabs-on-ground supporting storm shelters. Replacement or strengthening of existing slabs-on-ground where a storm shelter is to be installed shall not be required where all of the following conditions apply:

1. Community storm shelters that are a single story in height with a footprint of 64 ft^2 (5.95 m^2) or less or residential storm shelters.
2. The storm shelter are constructed out of concrete or concrete masonry**.**
3. Calculated soil pressure under the slabs-on-ground supporting the storm shelter walls does not exceed 2000 psf (95.8 kN/m^2) for design loading conditions other than design storm ~~shelter~~

events and 3000 psf (143.7 kN/m^2) for design storm ~~shelter~~ events.

4. The storm shelter is anchored at a minimum to the slab-on-ground at each corner of the structure and on each side of door openings in the shelter envelope.

701.1 Protection of *storm shelter critical support systems*. *Storm shelter critical support systems* shall remain functional for the design storm event and minimum period of *storm shelter* occupancy (24 hours for *hurricane shelters*, 2 hours for *tornado shelters*). *Storm shelter critical support systems* located outside of the *storm shelter* areas shall be protected by a means that meets the wind pressure and missile impact requirements of Chapter 3, and, as applicable, the flood-resistance requirements of Chapter 4.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:		**x**		

Your comment/reason: For better clarity, delete "type of" in Section 307.1. It is not necessary. In Section 307.3, Item 2, modify it to read: "storm shelter is constructed…"

Revise as follows:

307.1 **Connections of storm shelters to foundation~~s~~ systems.** Storm shelters shall be designed to resist all loads specified in Chapter 3 and to transfer the resultant forces into the ground with a ~~type of~~ foundation system.

307.3 Existing slabs-on-ground supporting storm shelters. Replacement or strengthening of existing slabs-on-ground where a storm shelter is to be installed shall not be required where all of the following conditions apply:

1. Community storm shelters that are a single story in height with a footprint of 64 ft^2 (5.95 m^2) or less or residential storm shelters.
2. The storm shelter ~~are~~ is constructed out of concrete or concrete masonry**.**
3. Calculated soil pressure under the slabs-on-ground supporting the storm shelter walls does not exceed 2000 psf (95.8 kN/m^2) for design loading conditions other than design storm shelter events and 3000 psf (143.7 kN/m^2) for design storm shelter events.
4. The storm shelter is anchored at a minimum to the slab-on-ground at each corner of the structure and on each side of door openings in the shelter envelope.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:		**x**		

Your comment/reason: *This provision does not require any minimum thickness of existing slab-on-ground as previously required by the code standard. Existing slabs-on-ground in actuality can be minimal as shown by actual installations of storm shelter in residential applications. In some garages, concrete can be as little as 2" in thickness which typically will not support proper anchorage of a prefab storm shelter. Without some type of investigation for shelters which are anchored to such slabs, the results could be disastrous.*

Is asphalt considered "slab-on-ground"? This is no distinction between concrete and asphalt. Asphalt does not have the pull out resistance of concrete.

No suggested revisions.

307.3 Existing slabs-on-ground supporting storm shelters. Replacement or strengthening of existing slabs-on-ground where a storm shelter is to be installed shall not be required where all of the following conditions apply:

1. Community storm shelters that are a single story in height with a footprint of 64 ft^2 (5.95 m^2) or less or residential storm shelters.
2. The storm shelter are constructed out of concrete or concrete masonry**.**
3. Calculated soil pressure under the slabs-on-ground supporting the storm shelter walls does not exceed 2000 psf (95.8 kN/m^2) for design loading conditions other than design storm shelter events and 3000 psf (143.7 kN/m^2) for design storm shelter events.
4. The storm shelter is anchored at a minimum to the slab-on-ground at each corner of the structure and on each side of door openings in the shelter envelope.

Section 308.1.1.1 was deleted, but shown here for what was in ICC 500 previously.

308.1.1.1 Slabs-on-grade. New or existing slabs-on grade shall be designed for the applicable loads in accordance with Section 301; however, The minimum thickness shall be 3-1/2 inches (88.9 mm) and the minimum steel reinforcement for slabs-on-grade resisting forces on the *storm shelter* shall be 6 × 6 – W1.4 × W1.4 welded wire reinforcement over the required area of slab or No. 4 bars, at a maximum spacing of 18 inches (457 mm) on center, in two perpendicular directions.

Exception: Concrete and concrete masonry *storm shelters* shall be permitted to be constructed within existing one- and 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 not exceed 2000 psf (95.8 kN/m^2) for design loading conditions other than design *storm shelter* events and 3000 psf (143.7 kN/m^2) 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.
3. Reinforcing in the slab-on-grade shall not be required where the dead load of the slab is not required to resist overturning.

IS-STM 03-30-18

ICC 500 Sections 306.1

Proponent: ICC 500

306.1 *Storm* ***Shelters*** **meeting tornado impact test requirements.** *Storm shelter envelope* components meeting missile impact test requirements for *tornado shelters* at the same geographic location shall be considered acceptable for *hurricane shelters* provided they meet structural design load requirements for *hurricane shelters*.

Reason: During the review of 03-28-18 the work groups 3 and 8 were asked to look at Section 306.1. Section 306.1 is revised to clarify that someone could not use the lowest possible tornado forces get you past higher hurricane requirements. The text indicates the forces for the location must be considered.

Committee Action: As Submitted (8-0)

Committee Reason: See reason

IS-STM 03-30-18

		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	1
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:		x		

Your comment/reason: In 306.1, the new phrase about geographic location is awkwardly located in the sentence, which makes the intent very unclear to the uninitiated reader. Revise as follows.

Revise as follows:

306.1 *Storm* ***Shelters*** **meeting tornado impact test requirements.** *Storm shelter envelope* components meeting missile impact test requirements for *tornado shelters* ~~at the same geographic location~~ shall be considered acceptable for *hurricane shelters* at the same geographic location provided they meet structural design load requirements for *hurricane shelters*.

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Dain PC:		x		

Your comment/reason:
Instead of same geographic location shouldn't this say something like "at the same or higher wind speed required for the hurricane shelter location per figure 304.2 (2)". All this section was trying to say is that no additional testing is required if an equivalent or more stringent criteria of missile size and speed are met.

Revise as follows:

306.1 Storm Shelters meeting tornado impact test requirements. Storm shelter envelope components meeting missile impact test requirements for tornado shelters at the same ~~geographic location~~ or higher wind speed required for the hurricane shelter location per figure 304.2 (2) shall be considered acceptable for hurricane shelters provided they meet structural design load requirements for hurricane shelters.

Chapter 4
SITING

IS-STM 04-08-18
ICC 500 Section 202 (New), 401.6(New), 404, 404.1

Proponent: ICC 500

Section 202

Definitions

COASTAL A ZONE. Area within a *special flood hazard area*, landward of a V zone or landward of an open coast without mapped *coastal high-hazard areas*. In a coastal A zone, the principal source of flooding must be astronomical tides, storm surges, seiches or tsunamis, not riverine flooding. During the base flood conditions, the potential for breaking wave height shall be greater than or equal to 1-1/2 feet (457 mm). The inland limit of the coastal A zone is one of the following:

3. The Limit of Moderate Wave Action if delineated on a FIRM.
4. Designated by the authority having jurisdiction.

COASTAL HIGH-HAZARD AREA. Area within the *special flood hazard area* extending from offshore to the inland limit of a primary dune along an open coast and any other area that is subject to high-velocity wave action from storms or seismic sources, and shown on a Flood Insurance Rate Map (FIRM) or other flood hazard map as velocity Zone V, VO, VE or V1-30.

~~**SECTION 404**~~
~~**SITING FOR COMMUNITY SHELTERS**~~

401.5 ~~**404.1**~~ **Community shelter siting**. Community storm 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).~~ Coastal high hazard areas and coastal A zones.
2. Floodways.

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

401.6 Residential shelter siting. Residential storm shelters shall be located outside of the following high-risk flood hazard areas:

1. Coastal high hazard areas and coastal A zones.
2. Floodways.

Exception: Residential storm shelters shall be permitted in Coastal high hazard areas and Coastal A zones where permitted by the Board of Appeals in accordance with the provisions of the *International Building Code* or *International Residential Code.*

Reason: This proposal addresses storm shelter flood siting hazards by 1) adding coastal A zones to the existing community storm shelter siting restrictions and 2) adding a new section for residential storm shelter siting that require residential storm shelters to be sited outside areas subject to high-velocity wave action (V Zones or coastal high hazard zones), areas designated as 'coastal A Zones', and floodways.

Definitions for 'coastal high-hazard area' and 'coastal A zone' are proposed to provide clarity for users and to correlate with terminology and definitions found in 2018 IBC.

The coastal A Zone (CAZ) has been in ASCE 7 since the late 1990s and in ASCE 24 since its initial publication in 1998. The 2015 and 2018 IBC treats Zones V and CAZ construction the same for elevation criteria and requires that all buildings designed and constructed in Special Flood Hazard Areas comply with ASCE 7 and ASCE 24. Accordingly this proposal will correlate provisions of ICC 500 with the IBC.

FEMA's many post-disaster investigations after severe coastal storms have long recommended application of coastal high hazard area (Zone V) requirements to areas inland of the Zone V/Zone A boundary – in the area subject to waves between 1.5 ft and 3 ft – the area now referred to as "Coastal A Zone". Starting in fiscal year 2009, all coastal flood studies by FEMA have included analyses of moderate wave action and FIRMs have shown the Limit of Moderate Wave Action (LiMWA).
The total land area that is likely to be designated as CAZ is small. FEMA has estimated that less than 3 percent of all mapped flood hazard areas are Zone V and the LiMWA generally is determined to be a relatively short distance inland from the Zone V boundary.
Flood siting restrictions for floodways and areas subject to coastal wave action are proposed to extend to residential storm shelters to protect all storm shelter occupants from the effects of high velocity flood waters. Like community storm shelters, an exception is provided where permitted by the Board of Appeals in accordance with the governing model building code.

Committee Action: Approved as Submitted (11-0)

Committee Reason: Agree with work group reason stated above.

IS-STM 04-08-18

IS-STM 04-08-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	0
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Manley Vote:		x		

Your comment/reason: Definition of "Coastal A Zone" has mandatory requirements in it. Shouldn't these be in the body of the standard?

No revisions suggested. The following is the definition and where used in the text.

COASTAL A ZONE. Area within a special *flood hazard area*, landward of a V zone or landward of an open coast without mapped *coastal high-hazard areas*. In a coastal A zone, the principal source of flooding must be astronomical tides, storm surges, seiches or tsunamis, not riverine flooding. During the base flood conditions, the potential for breaking wave height shall be greater than or equal to 1-1/2 feet (457 mm). The inland limit of the coastal A zone is one of the following:

1. The Limit of Moderate Wave Action if delineated on a FIRM.
2. Designated by the *authority having jurisdiction*.

402.2 Design criteria. The design and construction of *storm shelters* or portions thereof located in *flood*

hazard areas, including *coastal high-hazard areas* and *coastal A zones* shall be in accordance with the provisions of this chapter and ASCE 24 except for the floor elevations for *storm shelters* required in Section 402.7.

402.5 *Community* *storm* *shelter* siting. *Community storm shelters* shall be located outside of the following high-risk *flood hazard areas*:

1. *Coastal high-hazard areas* and *coastal A zones*.
2. Floodways.

Exception: *Community storm shelters* shall be permitted in *coastal high-hazard areas* and *coastal A zones* where permitted by the Board of Appeals in accordance with the provisions of the *International Building Code*.

402.6 *Residential* *storm* *shelter* siting. *Residential storm shelters* shall be located outside of the following high-risk *flood hazard areas*:

1. *Coastal high-hazard areas* and *coastal A zones*.
2. Floodways.

Exception: *Residential storm shelters* shall be permitted in *coastal high-hazard areas* and *coastal A zones* where permitted by the Board of Appeals in accordance with the provisions of the *International Building Code* or *International Residential Code.*

IS-STM 04-09-18

ICC 500 Section 107.2.1, 202 (New), 303.4, 401, 401.1(New), 401.2, 401.3(New), 401.4(New)

Proponent: ICC 500
Revised: 5-20-2019

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. through 8. *(no change to text)*
9. The minimum elevation of the lowest floor required by the authority having jurisdiction for the location where the shelter is installed; ~~Design Flood Elevation,~~ ~~and~~ the Base Flood Elevation (BFE); and the storm shelter floor elevation required in Section 401.7 for the site (if applicable).
10. and 11. *(no change to text)*
12. 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. The lowest shelter floor elevation and corresponding datum, except for residential tornado shelters outside of special flood hazard areas.
14. through 22. *(no change to text)*

Section 202
Definitions
FLOOD ELEVATION STUDY. An examination, evaluation and determination of flood hazard and, where appropriate, corresponding water surface elevations, or an examination, evaluation and determination of storm surge inundation, including coastal wave effects, associated with the maximum intensity hurricane.

FLOOD HAZARD AREA. The greater of the following two areas:
3. The area in a floodplain subject to a 1-percent or greater chance of flooding in any year.
4. The area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated.

SECTION 303
LOADS

303.4 Flood loads. Flood loads shall be determined in accordance with ASCE 7. The design flood elevation (DFE) for the storm shelter shall equal or exceed the minimum floor elevation as specified in Section 401 of this standard.

SECTION 401
FLOOD ~~ELEVATION~~ CRITERIA

401.1 General. Storm shelters sited within flood hazard areas shall consider flood elevations in accordance with this section. Such shelters shall be designed and constructed to resist the effects of flood hazards and flood loads in accordance with Section 303.4.

401.1 Minimum floor elevation of storm shelters.
401.1.1 Minimum floor elevation of community shelters.
401.1.2 Minimum floor elevation of residential shelters.
(Sections revised and relocated – see IS-STM 04-10-18)

401.2 Design criteria. The design and construction of Storm shelters or portions thereof ~~subject to flooding~~ located in *flood hazard areas,* including *coastal high hazard areas* and *coastal A zones* ~~-~~shall be

~~designed~~ in accordance with the provisions of this chapter, ~~ASCE 7, Section 5~~ and ASCE 24 except for the floor elevations for storm shelters required in Section 401.7 .

401.3 Determining flood elevations and floodway. The flood elevation and floodway shall be determined using the flood hazard map adopted by the applicable governing authority. Where flood elevations and floodway are not included in the flood hazard map, or where a *flood elevation study* is not adopted by the applicable governing authority, the flood elevation and floodway shall be determined in accordance with one of the following:

1. Utilize a flood elevation and floodway data available from federal, state or other approved source.
2. Determine the flood elevation and floodway in accordance with the accepted hydrologic and hydraulic engineering practices used to prepare a flood elevation study. Determination shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

401.4 Flood Information. Flood information shall be provided on the construction documents in accordance with Section 107.2.1.

Reason: This proposal seeks to update, correlate and clarify Chapter 4 requirements for ICC 500 users. Specifically, the proposal 1) clarifies where Chapter 4 requirements apply, 2) replaces existing 'flood of record' elevation criteria with criteria consistent with the 2018 IBC, and 3) cross references (and updates) the needed flood information with the corresponding documentation required in Chapter 1 of the standard.
Standard users that participate in Working Group 4 indicated the need for greater detail on the applicability of Chapter 4 requirements, so new provision 401.1 (General) clarifies that Chapter 4 requirements apply only to shelters within flood hazard areas; the definition for flood hazard areas is also added and correlates with 2018 IBC. Additionally, Section 401.2 (Design criteria) was updated to correlate with language from 2018 IBC Section 1612.2, and specifically maintains the reference to ASCE 24 to cover requirements for structures within flood hazard areas that are not included in other codes and standards (e.g. use of fill, flood- and corrosion- resistant materials, floodproofing, utilities and equipment, etc.)
Standard users also charged the Working Group with elimination of the 'flood of record' elevation criteria which was only intended for use where flood elevation and floodway data were unavailable. The approach taken to remove 'flood of record' criteria was to add Section 401.3 (Determination of flood elevation and floodway) before the shelter minimum floor elevation criteria so that designers could determine whether the referenced flood information for the proposed shelter site was available before pursuing alternate means. Where the data are unavailable, users are given two options – find data from alternate approved source or through hydrologic and hydraulic engineering study. The language for the options was adapted from and correlates with 2018 IBC Section 1612.3.1. Since a new term, 'Flood elevation study', is used in new Section 401.3, the 2018 IBC definition is also proposed.
Lastly, a cross reference is proposed in Section 401.4 (Flood elevation) to reinforce the need for flood criteria documentation. All items relevant to flood hazard siting from existing ICC 500 Section 107.2 are shown above for clarity, but only item #9 has been modified to place emphasis on the DFE which governs the minimum elevation of the shelter's lowest occupied floor or support area.

Committee Action: Approve as submitted (11-0)

Committee Reason: Agree with work group reason stated above.

IS-STM 04-09-18

IS-STM 04-09-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment

Report	13	2	0	0	0
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Levitan Vote:		**x**		

Your comment/reason:

The first sentence of 402.1 is awkward. The storm shelters are considering the flood elevations? That doesn't make much sense. Needs some wordsmithing here.

No revision suggested:

402.1 General. *Storm shelters* sited within *flood hazard areas* shall consider flood elevations in accordance with this section. Such *storm shelters* shall be designed and constructed to resist the effects of flood hazards and flood loads in accordance with Section 303.4.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:		**x**		

Your comment/reason: Why introduce a new term "applicable governing authority" in Section 402.3? It is undefined and only used twice in this one section. Can "authority having jurisdiction" suffice here instead?

Revise as follows:

402.3 Determining flood elevations and floodway. The flood elevation and floodway shall be determined using the flood hazard map adopted by the ~~applicable governing authority~~ authority having jurisdiction. Where flood elevations and floodway are not included in the flood hazard map, or where a *flood elevation study* is not adopted by the ~~applicable governing authority~~ authority having jurisdiction, the flood elevation and floodway shall be determined in accordance with one of the following:

1. Utilize a flood elevation and floodway data available from federal, state or other approved source.
2. Determine the flood elevation and floodway in accordance with the accepted hydrologic and hydraulic engineering practices used to prepare a *flood elevation study*. Determination shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

IS-STM 04-10-18
ICC 500 Sections 401.1, 401.1.1, 401.1.2

Proponent: ICC 500
Revised: 5-20-2019

Note: The requirements for community, residential, tornado and hurricane have been split. Since they were combined in Section 401.1.1 and 401.1.2, that section is shown repeated.

401.7 ~~401.1~~ Minimum floor elevation of storm shelters. Where storm shelters are sited within flood hazard areas, the minimum floor elevations of storm shelters shall be determined in accordance with ~~Section 401.1.1 or 401.1.2~~ 401.7.1, 401.7.2, 401.7.3 or 401.7.4, as applicable.

401.7.1 ~~401.1.1~~ Minimum floor elevation of community tornado shelters. The lowest floor used for the occupied shelter and occupant support areas of a community tornado shelter shall be elevated to or above the higher of the elevations determined by:

1.~~4.~~ The minimum elevation of the lowest floor required by the authority having jurisdiction for the location where the shelter is installed~~; or~~.

2.~~5.~~ ~~Two feet (610 mm)~~ One foot (305 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

3.~~1.~~ For storm shelters that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, the flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year~~; or~~.

4. For storm shelters that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, two feet (610 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

~~2. The flood elevation corresponding to the highest recorded flood elevation if a flood hazard study has not been conducted for the area; or~~

~~3. The maximum flood elevation associated with any modeled hurricane category, including coastal wave effects; or~~

Exception: ~~Items 1 and 3 shall not apply to shelters designed, constructed, designated and used only as tornado shelters.~~

Where a community shelter is located within a building that is constructed for dry floodproofing in accordance with ASCE 24 to the elevation prescribed by this section, the lowest floor level of the shelter is not required to comply with this section.

401.7.2 ~~401.1.1~~ Minimum floor elevation of community hurricane shelters. The lowest floor used for the occupied shelter and occupant support areas of a community hurricane shelter shall be elevated to or above the higher of the elevations determined by:

1.~~4.~~ The minimum elevation of the lowest floor required by the authority having jurisdiction for the location where the shelter is installed~~; or~~.

2.~~5.~~ Two feet (610 mm) above the flood elevation, including coastal wave effects, having a 1 percent annual chance of being equaled or exceeded in any given year.

3.~~1.~~ The flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year~~; or~~.

~~2. The flood elevation corresponding to the highest recorded flood elevation if a flood hazard study has not been conducted for the area; or~~

4.~~3.~~ The elevation corresponding to the maximum storm surge inundation~~, flood elevation associated with any modeled hurricane category~~, including coastal wave effects, associated with the maximum intensity hurricane modeled using the National Hurricane Center's *Sea, Lake and Overland Surges from Hurricanes* (SLOSH) for the location where the shelter is installed.~~; or~~

~~**Exception:** Items 1 and 3 shall not apply to shelters designed, constructed, designated and used only as tornado shelters.~~

401.7.3 ~~401.1.2~~ Minimum floor elevation of residential tornado shelters. The lowest floor ~~used for the occupied shelter area~~ of a residential tornado shelter shall be elevated to or above the higher of the elevations determined by:

~~1. The flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year; or~~

~~2. The flood elevation corresponding to the highest recorded flood elevation if a flood hazard study has not been conducted for the area; or~~

~~3. The maximum flood elevation associated with any modeled hurricane category, including coastal wave effects; or~~

1.~~4.~~ The minimum elevation of the lowest floor required by the authority having jurisdiction for the location where the shelter is installed.

2.~~—~~ In new buildings, one foot (305 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

~~**Exception:** Items 1 and 3 shall not apply to shelters designed, constructed, designated and used only as tornado shelters.~~

401.7.4 ~~401.1.2~~ Minimum floor elevation of residential hurricane shelters. The lowest floor ~~used for the occupied shelter area~~ of a residential hurricane shelter shall be elevated to or above the higher of the elevations determined by:

1.~~4.~~ The minimum elevation of the lowest floor required by the authority having jurisdiction for the location where the shelter is installed.

2.~~1.~~ The flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year~~; or~~.

~~2. The flood elevation corresponding to the highest recorded flood elevation if a flood hazard study has not been conducted for the area; or~~

3. The elevation corresponding to the maximum storm surge inundation~~, flood elevation associated with any modeled hurricane category~~, including coastal wave effects, associated with the maximum intensity hurricane modeled using the National

Hurricane Center's *Sea, Lake and Overland Surges from Hurricanes* (SLOSH) for the location where the shelter is installed.~~; or~~

~~**Exception:** Items 1 and 3 shall not apply to shelters designed, constructed, designated and used only as tornado shelters.~~

Reason: The Chapter 4 Work Group (WG) reviewed the public comments as well as member experience input and, for clarity, determined that the best approach is to separate the minimum flood elevation requirements into four sections instead of the previous two: tornado community and residential storm shelters, and hurricane community and residential. The highest flood-of-record was deleted as the WG agreed that there may be multiple entities that capture flood-of-record elevation and a design professional may have no way of knowing for sure that they have identified the entity with the needed data. Instead the WG determined that the minimum floor elevation established by the authority having jurisdiction can be a suitable alternative and address sites with inadequate flood data in Proposal 4-09-18.

The WG didn't have a consensus on need to elevate community tornado storm shelters in existing buildings. The need to elevate a tornado storm shelter to new construction elevation in an existing building may be technically infeasible due to ramp requirements in small public or private spaces, such as an administrative or commercial office, and fire or police stations. However, a design level flood may be coincident with a tornado threat or impact. Thus an exception is provided for facilities that are dry flood-proofed to the required floor elevation.

The WG determined that as a minimum community tornado storm shelters must comply with the appropriate Flood Design Class requirements of Table 2-1, ASCE 24-14 (e.g., Risk Category/Flood Design Class II or III is BFE+1 foot or DFE). The exception being tornado storm shelters located in Risk Category IV facilities, or those that support Risk Category IV facilities, which must comply with Flood Design Class IV. For residential tornado storm shelters of new construction, the WG determined that as a minimum the flood elevation must meet Design Flood Class 2 requirements. For residential tornado storm shelters installed or built into existing construction the minimum elevation established by the authority having jurisdiction is required (e.g., applicable existing building codes, regulations or policies). Storm surge isn't a consideration for facilities that serve solely as tornado storm shelters.

Hurricanes produce significant flood hazards, including storm surge and coastal wave effects. As such the WG determined that the standard for hurricane community storm shelters must continue to include Sections 401.1.1(1), (4) and (5), ICC 500-2014. The WG also determined that the storm surge requirement of Section 401.1.1(3), ICC 500-2014 must continue to be required but revised for clarity. The revised language specifically references the nationally-recognized authoritative storm surge inundation model: the National Hurricane Center's Sea, Lake and Overland Surges from Hurricanes (SLOSH). The local building code agency (authority having jurisdiction), emergency management or floodplain administrators have access to storm surge inundation data and maps.

As with community hurricane storm shelters, residential hurricane shelters must also include flood elevation standards consistent with the hurricane hazard. The WG determined that the standard for residential hurricane storm shelters must continue to include Sections 401.1.2(1), (3) and (4), ICC 500-2014. The storm surge section has also been revised for clarity and consistency with community hurricane storm shelter.

Committee Action: Approved as Submitted (10-0)

Committee Reason: Agree with work group reason stated above**.**

IS-STM 04-10-18

IS-STM 04-10-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	11	1	3	0	2
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:			x	

Your comment/reason:

The provisions of 402.7.1 for floor elevation of community tornado shelters are not appropriate for installation of tornado shelters in existing buildings. In many cases, it would not be possible to meet these elevation criteria at all, in other cases, extraordinarily expensive. We don't want to be in the situation of effectively preventing an existing building in floodprone area from installing a tornado shelter.

Revise as follows:

402.7.1 Minimum floor elevation of *community tornado shelters*. The lowest floor used for the *occupied storm shelter areas* and *occupant support areas* of a *community tornado shelter* shall be elevated to or above the higher of the elevations determined by all of the following:

1. The minimum elevation of the lowest floor required by the *authority having jurisdiction* for the location where the *community tornado shelter* is installed.
2. One foot (305 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.
3. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, the flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year.
4. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, two feet (610 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

~~**Exception**~~ **Exceptions**:

~~1.~~ Where a *community tornado shelter* is located within a building that is constructed for dry floodproofing in accordance with ASCE 24 to the elevation prescribed by this section, the lowest floor level of the *community tornado shelter* is not required to comply with this section.

2. Where a community tornado shelter is located within an existing building, items 2, 3, and 4 shall not apply.

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Manley Vote:			x	

Your comment/reason: While not opposed to referencing the "National Hurricane Center's *Sea, Lake and Overland Surges from Hurricanes"* in Sections 402.7.2 and 402.7.4 (Clean Draft), I think some additional information is needed, including the website and the equivalent of the "edition year" should be listed in Chapter 9 Referenced Standards. Otherwise, there is a risk that a substantial change is made to the basis of SLOSH that invalidates the approach taken in ICC 500 or makes it less conservative then the committee intends.

No revision suggested:

402.7.2 Minimum floor elevation of *community hurricane shelters*. The lowest floor used for the *occupied storm shelter areas* and *occupant support areas* of a *community hurricane shelter* shall be elevated to or above the higher of the elevations determined by all of the following:

1. The minimum elevation of the lowest floor required by the *authority having jurisdiction* for the location where the *community hurricane shelter* is installed.
2. Two feet (610 mm) above the flood elevation, including coastal wave effects, having a 1 percent annual chance of being equaled or exceeded in any given year.
3. The flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year.
4. The elevation corresponding to the maximum storm surge inundation, including coastal wave effects, associated with the maximum intensity hurricane modeled using the National Hurricane Center's *Sea, Lake and Overland Surges from Hurricanes* (SLOSH) for the location where the *community hurricane shelter* is installed.

402.7.4 Minimum floor elevation of *residential hurricane shelters*. The lowest floor of a *residential hurricane shelter* shall be elevated to or above the higher of the elevations determined by all of the following:

1. The minimum elevation of the lowest floor required by the *authority having jurisdiction* for the location where the *residential hurricane shelter* is installed.
2. The flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year.
3. The elevation corresponding to the maximum storm surge inundation, including coastal wave effects, associated with the maximum intensity hurricane modeled using the National Hurricane Center's *Sea, Lake and Overland Surges from Hurricanes* (SLOSH) for the location where the *residential hurricane shelter* is installed.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Scott Vote:		**x**		

Your comment/reason: Does the exception in Section 402.7.1 allow for in-ground storm shelters in a flood hazard area?

No revisions suggested:

402.7.1 Minimum floor elevation of *community tornado shelters*. The lowest floor used for the *occupied storm shelter areas* and *occupant support areas* of a *community tornado shelter* shall be elevated to or above the higher of the elevations determined by all of the following:

1. The minimum elevation of the lowest floor required by the *authority having jurisdiction* for the location where the *community tornado shelter* is installed.
2. One foot (305 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

3. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, the flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year.
4. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, two feet (610 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

Exception: Where a *community tornado shelter* is located within a building that is constructed for dry floodproofing in accordance with ASCE 24 to the elevation prescribed by this section, the lowest floor level of the *community tornado shelter* is not required to comply with this section.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Tezak Vote:			**x**	

Your comment/reason: I do not support the new exception under 402.7.1 related to dry floodproofing. " There is debate on how "rare" the likelihood of a tornado and a design flood event occurring simultaneously it may and it has happened. This standard is to provide life-safety protection for people during these hazard events. How is this the case when per ASCE 24 it states that dry floodproofing that requires human intervention shall be permitted only when all occupants can be evacuated from the area protected by the measures?
Having led and supported over a dozen post-disaster building performance assessments for FEMA, there is a large body of evidence that point to high failure rates with respect to the measures failing or being overtopped (for events that are at or below the design flood event). Dry floodproofing is allowed in limited cases by the building code in an effort to economically mange the impact of flood hazards on buildings. As this standard deals with the protection of lives, it should not be allowed due to the multiple factors that must be considering during design and maintenance of the storm shelter area during its useful life.

Revise as follows:

402.7.1 Minimum floor elevation of *community tornado shelters*. The lowest floor used for the *occupied storm shelter areas* and *occupant support areas* of a *community tornado shelter* shall be elevated to or above the higher of the elevations determined by all of the following:

1. The minimum elevation of the lowest floor required by the *authority having jurisdiction* for the location where the *community tornado shelter* is installed.
2. One foot (305 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.
3. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, the flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year.
4. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, two feet (610 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

~~**Exception:** Where a *community tornado shelter* is located within a building that is constructed for dry floodproofing in accordance with ASCE 24 to the elevation prescribed by this section, the lowest floor level of the *community tornado shelter* is not required to comply with this section.~~

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Brendel PC:	**x**			

Your comment/reason: I am the flood plain manager and accessibility specialist for the City of St. Louis. The Chief Plans Examiner and I have reviewed the proposal for flood elevations for storm shelters in Section 402. We want to support the committee adding the exception to Section 402.7.1. St. Louis is in a flood zone, as well as in the tornado belt. We are looking at the addition of tornado shelters in new and existing buildings that house emergency responders.

If the water were rising to an extent that there was danger of emergency structures flooding, responders would be evacuation of those buildings to higher ground along with anyone else in the endangered area.

The city has several fire stations, which also house EMS vehicles that are now in a 500-year area due to the reconfiguration of the maps due to Katrina. Community shelters all have to be on an accessible route. To require storm shelters to have an area raised a minimum of two feet with a ramp not less than twenty-four feet with the assumption that three things (river in flood, levee breach and a tornado) are going to happen simultaneously is not justifiable.

Supporting Approval as Submitted.

402.7.1 Minimum floor elevation of *community tornado shelters*. The lowest floor used for the *occupied storm shelter areas* and *occupant support areas* of a *community tornado shelter* shall be elevated to or above the higher of the elevations determined by all of the following:

1. The minimum elevation of the lowest floor required by the *authority having jurisdiction* for the location where the *community tornado shelter* is installed.
2. One foot (305 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.
3. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, the flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year.
4. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, two feet (610 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

Exception: Where a *community tornado shelter* is located within a building that is constructed for dry floodproofing in accordance with ASCE 24 to the elevation prescribed by this section, the lowest floor level of the *community tornado shelter* is not required to comply with this section.

	Committee action: Approval as Submitted

	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Perotin PC:			x	

Your comment/reason: Thank you for the opportunity to provide public comments on ICC-500. I have been on a variety of post-disaster damage assessment teams since Hurricane Katrina, including a team that focused on dry floodproofing following Hurricanes Sandy and Harvey. I have two comments:

1) I would highly recommend the new exception under 402.7.1 related to dry floodproofing be reconsidered. While the likelihood of a tornado and design flood event happening simultaneously may be rare in some parts of the country, they can and have happened. In addition, you are potentially placing people in area that must be evacuated (per ASCE 24 – dry floodproofing that requires human intervention shall be permitted only when all occupants can be evacuated from the area protected by the measures). Based on the performance of dry floodproofing measures, there is high failure rate without the measures being overtopped (below design flood event). The likelihood of the shelter being available over the life of the building could be impacted as well, since there is a possibility it is being repaired. There are several factors, but most of all I would be concerned with occupants sheltering in place and the measure fails. If anything, I would recommend the committee consider allowing the building itself be dry floodproofed, however the shelter-in-place portion of the shelter should be elevated above the required elevation. For example, the ground floor maybe a parking garage or lobby that is dry floodproofed, with the shelter being located on the second floor (that meets the ICC-500 elevation requirements). While I would not necessarily be in favor of this approach, it is better than having occupants sheltering in place and relying on a temporary flood shield, sump pump, and/or other measure to protect them.
2) A proposed change to Section 402.7.1 conflicts with the IBC. It appears the 0.2-percent annual chance of being equaled or exceeded in any given year only applies to "storm shelters that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code" The IBC, by reference to ASCE 24, requires the minimum elevation of Flood Design Class 4 buildings to be minimum of the "BFE + 2 ft or DFE, or 500-year flood elevation, whichever is higher." While ASCE 7 Section 1.5 and commentary looks at Risk Category IV, and from a wind load standpoint since the importance factors resulting from the RC IV map (3000 MRI) are much lower than required for ICC 500 so the increased loads are already addressed; however there are NO importance factors impacted for flood. In my opinion, this proposed change conflicts with ASCE 24. The code changes to 2018 IBC regarding "emergency shelters" applied to the Risk Category table in the IBC, but NOT Flood Design Classes in ASCE 24, to my knowledge no one consulted with ASCE 24 on this matter. Based on ASCE 24 Flood Design Class 4 definition, including "(3) designated emergency shelters;" EVERY shelter is a Flood Design Class IV so there is no need to call this out (because all shelters must be elevated to the "minimum of the BFE + 2 ft or DFE, or 500-year flood elevation, whichever is higher"). If there is any doubt I would recommend the Committee consult with IBC and ASCE 24 for an interpretation, but in my opinion there is no reason a community shelter covered by 402.7.1 would not be considered Flood Design Class IV and required to be elevated to at least the 500-year flood elevation, so why add this language/condition. In addition to potentially flooding during occupancy, why would this standard allow for siting in the SFHA; we are constantly seeing these floodplains inundated and even seeing communities regulate Risk Category II and Flood Design Class II construction to the 500-year flood elevation. These

shelters are a long term investment for a community to protect its citizens, why allow it to be flooded during occupancy or during a non high wind event that means it has to be repaired and potentially uninhabitable when needed. Finally, the number of communities that have different facilities for sheltering in place (ride out the tornado, hurricane, etc.) versus a long term emergency/post disaster shelter are few and far between, trying to differentiate requirements is not practical. This standard should result in a facility the community can rely about to provide safe refuge in any circumstance – tornado, hurricane, flood, post-disaster long term, etc.

Revise as follows for Item 1. No revision suggested for Item 2.

402.7.1 Minimum floor elevation of *community tornado shelters*. The lowest floor used for the *occupied storm shelter areas* and *occupant support areas* of a *community tornado shelter* shall be elevated to or above the higher of the elevations determined by all of the following:

1. The minimum elevation of the lowest floor required by the *authority having jurisdiction* for the location where the *community tornado shelter* is installed.
2. One foot (305 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.
3. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, the flood elevation, including coastal wave effects, having an 0.2-percent annual chance of being equaled or exceeded in any given year.
4. For *storm shelters* that are Risk Category IV facilities or serving Risk Category IV facilities in accordance with Table 1604.5 of the International Building Code, two feet (610 mm) above the flood elevation having a 1 percent annual chance of being equaled or exceeded in any given year.

~~**Exception:** Where a *community tornado shelter* is located within a building that is constructed for dry floodproofing in accordance with ASCE 24 to the elevation prescribed by this section, the lowest floor level of the *community tornado shelter* is not required to comply with this section.~~

Chapter 5
OCCUPANCY, MEANS OF EGRESS, ACCESS AND ACCESSIBILITY

IS-STM 05-03-18
ICC 500 Section 501.1.2.1

Proponent: Corey Shultz, Schultz Squared Architects LLC

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.

   Exceptions:

   1. Tornado shelter toilet facilities required by Section 702.2 and designed as single-use toilet facilities shall not be calculated as usable floor area.
   2. Hurricane shelter toilet facilities shall not be calculated as usable shelter floor area.

Reason: Exception 1-Many shelters have single-use toilet facilities (unisex) which are provided per the requirements of section 702.2. In many cases, these toilet facilities are calculated to provide shelter for 5-10 occupants depending on the floor area of the toilet. Single-use toilet facilities are intended to be private. Typically, no one is going to use a toilet facility with 4-9 potential strangers in very close proximity rendering the toilet facility useless. The option and practical solution is to have all but the one individual using the facility to leave the room which then makes the main portion of the shelter undersized.

Exception 2-Due to the duration of a hurricane shelter, toilet facilities should not be included in the usable area calculations. Any expectation of a hurricane shelter occupant being in a toilet facility for a 24 hour duration is unreasonable. If toilet facilities are included in the usable area calculations, the probability of the main shelter area being undersized is high because toilets facilities will not be utilized.

Staff note: An exception is a choice, not a requirement. These provisions appear to be limitations, so they should not be exceptions. There also might be confusion as to if a bathroom could or could not serve as a hurricane shelter, of if this was just the required fixtures for the hurricane shelter. Suggested language might be the following:

Toilet stalls or single occupant toilet rooms provided to meet the requirements for toilet facilities in Section 702.2 and 703.2 shall not be included in the usable floor area.

Committee Action: Approved as Modified (7-0) (1 Abstain)

Replace with the following:

OCCUPANT SUPPORT AREAS. The areas required to ensure the health, safety and well-being of occupants. Occupant support areas include, but are not limited to, shelter management, food preparation, water and food storage, electrical and mechanical rooms, toilet and other sanitation rooms and first-aid stations.

OCCUPIED SHELTER AREAS. The designated storm shelter area within the shelter envelope and excluding occupant support areas.

USEABLE SHELTER FLOOR AREAS. The portions of the floor area within the shelter envelope not including occupant support areas, used to determine the maximum occupant load of the shelter.

501.1.3 Tornado Shelter Usable shelter floor area. In tornado community the following occupant support areas shall be permitted to be considered usable floor area;

1. Where the entire shelter is a single occupant toilet room area.
2. Where the shelter includes multi-stall toilet rooms, the toilet room area other than the toilet stalls and temporary toilet stations privacy areas provided to meet the requirements for toilet stations in Section 702.2. The usable shelter floor area shall be calculated by Section 501.1.1, 501.1.3.2 or a combination of these methods *(see 05-01).*

501.1.23.1 Calculation of usable floor area.

501.1.23.2 Alternative calculation of usable floor area.

702.2 Sanitation facilities. Toilet and hand-washing facilities shall be located within the tornado shelter area and provided in the minimum number shown in Table 702.2.

702.2.1 Required toilets and hand-washing facilities…..

702.2.2 Additional facilities for storm shelters…..

702.2.3 Toilet station privacy. Each toilet station shall occupy a separate compartment with walls, partitions, curtains or equivalent that enclose the fixtures to ensure privacy.

703.2 Sanitation facilities. Toilet and hand-washing facilities shall be located within the storm shelter area and provided in the minimum number shown in Table 703.2.

703.2.1 Required toilets and hand-washing facilities…..

703.2.2 Additional facilities for storm shelters….

703.2.3 Toilet station privacy. Each toilet station shall occupy a separate compartment with walls, partitions, curtains or equivalent that enclose the fixtures to ensure privacy.

Committee Reason: Clarification of usable shelter area for occupants use. Privacy requirements are added in Chapter 7.

IS-STM 05-03-18

IS-STM 05-03-18		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**14**	**1**	**0**	**0**	**1**

Staff Notes: Table 502.2 and 503.2 use the defined term 'useable storm shelter floor area'. For consistency, it appears this should also be used in 502.2? In the 2nd sentence, 'applicable' is not needed with the defined term. 'Section" is a missing word errata.

Revise as follows:

502.2 Occupant density. The minimum required ~~community~~ *usable storm shelter floor area* per occupant for *community storm shelters* shall be determined in accordance with Table 502.2, and Sections 502.3. The number and type of occupants served by the *storm shelter* shall be determined based upon the needs of the *storm shelter* as determined by the ~~applicable~~ *authority having jurisdiction* and the designer. Each *storm shelter* shall be sized to accommodate a minimum of one wheelchair space for every 200 storm shelter occupants or portion thereof.

503.2 ~~502.4~~ Occupant density. The minimum required *usable storm shelter floor area* per occupant for *residential storm shelters* shall be determined in accordance with Table 503.2 and Section 503.3.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Levitan Vote:		**x**		

Your comment/reason:

Wording of 502.4 is awkward, suggest revise item 1 as follows. Item 2 is also awkward leading with 'Where', and should be similarly reorganized.

Revise as follows:

502.4 *Tornado Shelter* Usable floor area. In *community tornado shelters* the following *occupant support areas* shall be permitted to be considered *usable storm shelter floor area*;

1. The room area Where the entire *storm shelter* is a single occupant toilet room area.
2. Where the *storm shelter* includes multi-stall toilet rooms, the toilet room area other than the toilet stalls and temporary toilet stations privacy areas provided to meet the requirements for toilet stations in Section 702.2. The *usable storm shelter floor area* shall be calculated by Section 502.3.1, 502.3.2, or a combination of these methods.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**

Dain PC:		x		

Your comment/reason:

a.No, this does not exclude occupant support areas. Delete this text. Transcribing error “area”. See comment to IS-STM 07-13-18 for ‘occupant support areas’

Revise as follows:

OCCUPIED STORM **SHELTER AREAS.** The designated *storm shelter* area ~~area~~ within the *storm shelter envelope* ~~and excluding *occupant support areas*~~.

b.Need to keep the term “Useable Floor Area” intact, do not need to say storm shelter. “Maximum storm shelter” is repetitive.

Revise as follows:

106.2.1 Design information….

17. Calculations for the *usable* ~~*storm shelter*~~ *floor area*.

USABLE ~~STORM **SHELTER**~~ **FLOOR AREAS.** The portions of the floor area within the *storm shelter envelope* not including *occupant support areas*, used to determine the ~~maximum *storm shelter*~~ *design occupant capacity* of the *storm shelter*.

SECTION 502
OCCUPANCY DENSITY IN COMMUNITY STORM SHELTERS

502.1 General. A community storm shelter shall comply with the requirements of Section 502.2 through 502.4.

502.2 Occupant density. The minimum required ~~community storm shelter~~ usable floor area per occupant for community storm shelters shall be determined in accordance with Table 502.2, and Sections 502.3. The number and type of occupants served by the storm shelter shall be determined based upon the needs of the storm shelter as determined by the applicable authority having jurisdiction and the designer. Each storm shelter shall be sized to accommodate a minimum of one wheelchair space for every 200 storm shelter occupants or portion thereof.

Table 502.2
OCCUPANT DENSITY – COMMUNITY STORM SHELTERS

TYPE OF OCCUPANTS	MINIMUM REQUIRED *USABLE* ~~*STORM SHELTER*~~ *FLOOR AREA* IN SQUARE FEET PER OCCUPANT
Tornado	
Occupants who are Standing or seated	5
Occupants using a Wheelchair	10
Occupants who are relocated in a bed or stretcher	30
Hurricane	
Occupants who are Standing or seated	20
Occupants using a Wheelchair	20
Occupants who are relocated in a bed or stretcher	40

For SI: 1 square foot = 0.0929 m^2.

502.3 *Usable ~~storm shelter~~ floor area*. The *usable ~~storm shelter~~ floor area* shall be determined by Section 502.3.1, 502.3.2 or a combination of these methods.

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

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

502.3.2 Alternative calculation of usable floor area. The *usable ~~storm shelter~~ floor area* shall be determined by subtracting from the gross floor area, the floor area partitions and walls, columns, fixed or movable objects, furniture, equipment or other features that under probable conditions cannot be removed

502.4 *Tornado Shelter* Usable floor area. In *community tornado shelters* the following *occupant support areas* shall be permitted to be considered *usable ~~storm shelter~~ floor area*;

1. Where the entire *storm shelter* is a single occupant toilet room area~~.~~
2. Where the *storm shelter* includes multi-stall toilet rooms, the toilet room area other than the toilet stalls and temporary toilet station~~s~~ privacy areas provided to meet the requirements for toilet stations in Section 702.2. The *usable **storm** shelter floor area* shall be calculated by Section 502.3.1, 502.3.2, or a combination of these methods.

SECTION 503
OCCUPANT DENSITY IN RESIDENTIAL STORM SHELTERS

503.1 General. A *residential storm shelter* shall comply with the requirements of Section 503.1 through 503.3 .

503.2 Occupant density. The minimum required *usable ~~storm shelter~~ floor area* per occupant for *residential storm shelters* shall be determined in accordance with Table 503.2 and Section 503.3.

TABLE 503.2
OCCUPANT DENSITY—*RESIDENTIAL STORM SHELTERS*

TYPE OF OCCUPANTS	MINIMUM REQUIRED *USABLE ~~STORM SHELTER~~ FLOOR AREA* IN SQUARE FEET PER OCCUPANT
Tornado	
One- and two-family dwelling	3
Other residential	5
Hurricane	
One- and two-family dwelling	7
Other residential	10

For SI: 1 square foot = 0.0929 m^2.

503.3 Usable ~~storm shelter~~ floor area. The *usable ~~storm shelter~~ floor area* shall be determined by subtracting from the gross floor area, the floor area partitions and walls, columns, fixed or movable objects, furniture, equipment or other features that under probable conditions cannot be removed.

c. Does this mean toilet rooms provided beyond what is required may be used as usable floor area?

Users don't know which toilets are required and which are additional.

No revisions suggested.

502.4 *Tornado Shelter* Usable floor area. In *community tornado shelters* the following *occupant support areas* shall be permitted to be considered *usable storm shelter floor area*;

1. Where the entire *storm shelter* is a single occupant toilet room area~~.~~
2. Where the *storm shelter* includes multi-stall toilet rooms, the toilet room area other than the toilet stalls and temporary toilet station~~s~~ privacy areas provided to meet the requirements for toilet stations in Section 702.2. The *usable* ***storm*** *shelter floor area* shall be calculated by Section 502.3.1, 502.3.2, or a combination of these methods.

IS-STM 05-05-18
ICC 500 Section 501.2, 501.3, 602.1, 702.1.1.1, 702.3, 702.4(New)

Proponent: Benchmark Harris, The National Storm Shelter Association (NSSA) Design Practices Committee

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.

For shelters with multiple stories, it shall be required to comply with the applicable building code requirements for the number and location of stairways and elevators, based on the normal occupancy for facilities that are not used solely for shelters. There shall be at least one stairway within the shelter perimeter for each story. The elevator is not required to be located in the shelter perimeter.

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 are not required to have an emergency escape opening.

501.3 Direction of swing. The direction of swing of doors shall be as required by the applicable building code for the normal occupancy of the space. For shelters with multiple stories, it shall be permitted for doors between shelters and host building areas to swing out toward the host building areas on the upper floors without a guard or any fall protection.

602.1 General. A fire extinguisher shall be required within each story of all community shelters.

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 (2591 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 on an opposite wall or the roof surface to provide cross ventilation of the shelter. For shelters with multiple stories, natural ventilation openings shall be provided separately for each story in accordance with this section to provide the required area associated with the number of occupants at each story.

Exception: Air intake openings for residential tornado shelters shall be permitted to be located entirely in the upper half of the shelter provided that the venting area is increased to 4 square inches (1290 mm^2) per shelter occupant.

702.3 Emergency lighting. Community tornado shelters with a shelter occupant load greater than 50 shall be provided with an emergency lighting system. The emergency lighting system shall provide an average of 1 foot-candle (11 lux) of illumination in occupied shelter areas, occupant support areas, required corridors, passageways and means of egress.

702.4 Standby power. Community tornado shelters with a shelter occupant load greater than 50 shall be provided with a standby electrical power system. At a minimum, the standby electrical power system shall supply power to emergency lighting and any critical support systems that require power to be functional. Where host buildings have multiple stories, the emergency power system is not required to provide back-up power to elevators in host buildings. Where shelters have multiple stories, the emergency power system is not required to provide back-up power to any elevators within the shelter perimeter.

~~**702.3.1**~~ **702.4.1 Capacity**. The emergency electrical power system shall have adequate capacity and rating to supply all required systems and circuits intended to be operated at one time.

~~**702.3.2**~~ **702.4.2 Duration.** The emergency electrical power system shall be designed to provide continuously the required output capacity for a minimum of 2 hours.

~~**702.4**~~ **702.5 First aid kit.** A first aid kit shall be supplied in all tornado shelters with a shelter occupant load of greater than 50.

Reason:

The current provisions do not prohibit multi-story shelter construction but they do not address some unique conditions associated with multi-story shelter construction.

Regarding 501.2: Because the number and location of means of egress doors (which includes stairs) from a space shall be determined for the normal occupancy of the space, it is possible to design a multi-story shelter which has no stairs in the shelter perimeter, using the original language in the code if there are doors at the shelter perimeter adjacent to host building(s) with stairs. It is not necessary to require a minimum of two means of egress from upper floors in the shelter itself during shelter occupancy because the primary purpose of the shelter is to protect occupants from the storm and not from a fire inside the shelter. The occupants should not be involved in activities that are likely to create a fire during shelter occupancy. And, section 602 requires a fire extinguisher. Shelter perimeter doors in a corridor leading to a host building can create a dead end corridor for adjacent host buildings when they are closed, which means that the host building areas on upper floors will

need to have at least two means of egress. Requiring at least two means of egress for the shelter too would require at least four stairs in many buildings that would normally only require two stairs.

Regarding 501.3: The host building's upper floors and stairs should be navigable unless there is an extremely destructive tornado, which would be a very rare occasion. In the event that such a rare occasion occurs, occupants will need to overcome the possible drop in elevation at the host building upper floor levels as they will have to overcome many other unpredictable and dangerous obstacles as they exit the shelter through debris and shifted structures, but the proposed requirement in 501.2 for at least one stair to be in the shelter allows occupants on upper

floors to evacuate to the lower floor level in a calm and organized fashion.

Regarding 602.1: This proposed revision would require one fire extinguisher at each floor level to help occupants manage any fire that may occur without having to use the stairs. This is an increase from the one fire extinguisher for the entire shelter that is currently required.

Regarding 702.1.1.1: Natural ventilation systems should be designed to allow air to flow in each floor level so as to ventilate all floor levels. The current language could be misinterpreted to provide low openings on one side of the lowest level and upper openings on the other side of the highest level, which would not necessarily provide adequate ventilation for the occupants, creating a life safety issue.

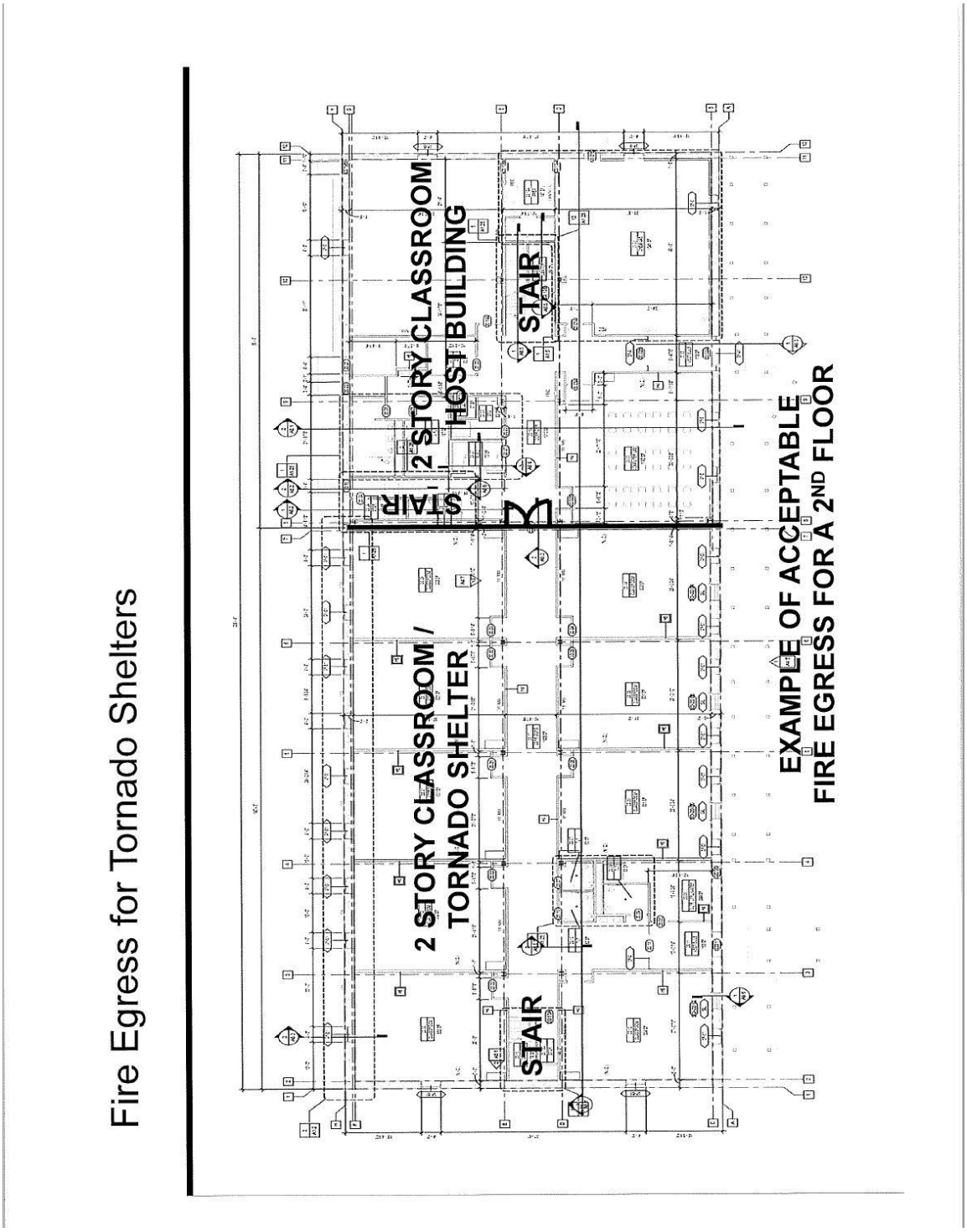
Regarding the proposed 702.4: The addition of the proposed 702.4 would make the language for tornado shelters parallel the existing language for hurricane shelters in Section 703. In many cases, elevators will function under normal power at multi-story host buildings and multi-story shelters. If power fails to host building elevators, the same procedures will apply to assisting people that need assistance, such as occupants in wheelchairs, as when there is a fire and these occupants cannot use the elevators. And, in most cases, people in wheelchairs will not need to move up and down floor levels within a shelter once they have reached the safety of the shelter. The original 702.3.1 and 702.3.2 are proposed to be renumbered under the proposed 702.4 to be parallel with the existing language in for hurricane shelters in Section 703.

Regarding the proposed 702.5: Changing the original 702.4 to the proposed 702.5 is only a change to the section number because of the addition of the proposed 702.4.

In many cases, elevators will function under normal power at multi-story host buildings and multistory shelters. If power fails to host building elevators, the same procedures will apply to assisting people that need assistance, such as occupants in wheelchairs, as when there is a fire and these occupants cannot use the elevators. And, in most cases, people in wheelchairs will not need to move up and down floor levels within a shelter once they have reached the safety of the shelter.

Substantiation to support proposed change:

Attached is a slide from a PowerPoint Presentation given by Rick Herzberger, Chief Building Official with the City of McKinney, Texas at the 2017 Storm Shelter Conference.



Committee Action: As modified (6-0 meeting) (11-0 electronic vote)

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 from the storm shelter, an emergency escape opening shall be provided in accordance with Section 501.4.

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

501.6 Multi-story shelter. *Storm* shelters with multiple stories shall be required to have one emergency means of vertical access provided within the storm shelter to a level of exit discharge provided by a stairway complying with Section 502.3.1 or a ladder complying with Section 502.3.2, or an alternating tread device complying with Section 502.3.3.

602.1 General. A fire extinguisher shall be required within each story of all community shelters.

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 (2591 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 on an opposite wall or the roof surface to provide cross ventilation of the shelter. For tornado shelters with multiple stories, natural ventilation openings shall be provided for the occupants served for each story.

Exception: Air intake openings for residential tornado shelters shall be permitted to be located entirely in the upper half of the shelter provided that the venting area is increased to 4 square inches (1290 mm^2) per shelter occupant.

703.1.3 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 on an opposite wall or the roof surface to provide cross ventilation of the *shelter.* For hurricane shelters with multiple stories, natural ventilation openings shall be provided for the occupants served for each story.

Committee Reason: The proposal will address concerns unique to multi-story shelters.
Reasons for modifications –
Many of the statements are "not" required, instead of requirements.
501.2 – means of egress stairway in the shelter could be a conflict with building code requirements for exit separation.
702.1.1.1 – additional language not needed. The standard should allow options for shelters with opening between floors – such as mezzanines or atrium spaces.
702.3 and 702.4 – addressed in revisions in IS-STM 07-13-18

Note: Due to the discussion on this item Work Group 5 is working on a proposal to clarify the requirements for stairways, alternating tread devices and ladders.

IS-STM 05-05-18

IS-STM 05-05-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	15	0	0	0	1
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:			**x**	

Your comment/reason:
Delete this section, not needed and multiple issues with the way it is written

Revise as follows:

~~**504.6 Multi-story shelter.** *Storm* shelters with multiple stories shall be required to have one emergency means of vertical access provided within the storm shelter to a level of exit discharge provided by a emergency stair complying with Section 506.2 or a ladder complying with Section 506.3, or an alternating tread device complying with Section 506.4.~~

IS-STM 05-06-18
ICC 500 Section 501.3

Proponent: Chuck Miccolis, Insurance Institute for Business and Home Safety

Revise as follows:

501.3 Direction of swing. The direction of the swing of doors shall be as required by the applicable building code for the normal occupancy of the space, and the manner tested for the conditions of swing and latching, including panic hardware, as specified for application of the product.

Reason: In order to prevent improper installations, we believe it should be stated that the door, and its swing direction, must be installed in accordance with the manner the door was tested.

Committee Action: As Modified (8-0)

Replace as follows:

501.3 Direction of swing. The direction of the swing of doors shall be as required by the applicable building code for the normal occupancy of the space and in accordance with the manufacturer's listing.

Section 202
LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the *building* official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

Committee Reason: It is the listing of a product determines the swing direction, not the 'manner tested'. 'Specified for application of the product' does not provide sufficient guidance. Conditions of swing and latching are mandatory requirements in Ch 8 –no need to repeat it in Ch 5. The definition for 'listed' is copied from the I-codes. Used also in Section 803.1 – "Doors, windows and impact-protective systems are to be tested at the maximum and minimum size listed for use."

IS-STM 05-06-18

IS-STM 05-06-18		**Committee action: Approval as Modified**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**14**	**1**	**0**	**0**	**0**
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:		**x**		

Your comment/reason: The definition of "listed" makes reference to "building official", which is not used in the standard. Change to "authority having jurisdiction".

Revise as follows:

LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the ~~*building* official~~ authority having jurisdiction and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

IS-STM 05-09-18
ICC 500 Sections 108.1, 504.1, 504.1.1, 504.1.2, 504.1.2.1

Proponent: Daniel A. Dain, AIA, representing Stantec Architecture Inc.

Revise as follows:

108.1 Design information. ~~All shelters shall have a sign on or within the shelter with the name of the manufacturer or builder of the shelter and the storm type(s) and respective design wind speed(s). The sign shall remain legible and visible~~ Design information signs shall comply with Section 504.

SECTION 504
SIGNAGE FOR COMMUNITY SHELTERS

504.1 Signage requirements. Community storm shelter areas shall be marked by signage in accordance with this section. ~~Signage is required within a facility to direct occupants to storm shelter areas.~~ Signs shall remain legible and visible. Signs shall be posted in a prominent location 60 inches maximum above the finished floor, measured from the baseline of the highest tactile character, and shall comply with the applicable requirements of ICC A117.1.

504.1.1 Design information. All shelters shall have a sign on or within the shelter with the name of the manufacturer or builder of the shelter, the storm types and respective design wind speeds.

504.1.2 Shelter location. Signage is required within a facility to direct occupants to storm shelter areas.

~~**504.1.1**~~ **504.1.3** ~~**Signage location**~~ **Shelter entrances.** 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 comply with the applicable requirements of ICC A117.1.~~

~~**504.1.2**~~ **504.1.4 Identifying sign.** A sign depicting the general location of storm shelter areas and accessways shall be displayed in all of the following locations:

1. Adjacent to access doors on the inside of the storm shelter;
2. In the office of the facility manager, where provided; and
3. In the designated shelter manager’s area within the storm shelter, where provided.

~~**504.1.2.1 Location of identifying sign.** The identifying sign shall be posted in a prominent location 60 inches above the finished floor to the centerline of the sign.~~

Reason: Signage information in two locations is confusing. Added language and order provides organization of the text and clearly identifies the 4 types of signs and their requirements.

504.1 - ICC 500-2014 Section 504.1.1 requires signage comply with ICC A117.1. The ADA Standard and ICC A117.1 both require the baseline of the highest tactile character to be a maximum of 60 inches AFF, which is different than the original language in ICC 500-2014 Section 504.1.2.1, creating an inconsistency in ICC 500 and a possible violation of ADA. The proposed revision would make ICC 500 compatible with ADA and ICC A117.1.

504.1.2 – These signs shall have a floor plan of the building with the location of the storm shelter clearly indicated and the location of the sign identified by "You are here" with direction arrow to shelter. The number and placement of the signs shall be determined by the design professional since facility types and sizes vary greatly.

504.1.4 – These signs shall show a floor plan of the storm shelter labeling each area and accessway.

Staff note: IBC Appendix E and ICC A117.1 has requirements for tactile and braille requirements for permanent room identification. If this identifying sign is a visual indicator that you want to see over the heads of the crowd, that information is required to meet visual requirements only (such as an exit sign or the stairway information sign inside a stairway.) Tactile and braille signage is typically a separate sign that is located next to the door.

Committee Action: Approved as modified (12-0)

Replace with the following:

SECTION 108
~~DESIGN INFORMATION SIGNAGE AND~~ LABELING

~~**108.1 Design information.** All shelters shall have a sign on or within the shelter with the name of the manufacturer or builder of the shelter and the storm type(s) and respective design wind speed(s). The sign shall remain legible and visible.~~

~~**108.2**~~ **108.1 Labeling.** Impact-protective systems shall be labeled denoting compliance with this standard. Other than impact protective systems, products, materials or systems shall be labeled by an approved agency when required by the applicable code or jurisdiction.

SECTION 504
SIGNAGE ~~FOR COMMUNITY SHELTERS~~

504.1 Signage requirements. Community storm shelter areas shall be marked by signage in accordance with this section. ~~Signage is required within a facility to direct occupants to storm shelter areas~~. The signs shall comply with the visual character requirements of ICC A117.1.

504.1.1 Shelter entry sign ~~Signage location.~~ ~~At every entrance to a storm shelter, signage~~ Signage indicating "Tornado Shelter," or "Hurricane Shelter," ~~or~~ and appropriate symbols as applicable, shall be installed outside the storm shelter, adjacent to every door or alcove/baffled entry system intended to provide entry into the shelter. ~~The signs shall comply with the applicable requirements of ICC A117.1.~~

504.1.2 Shelter perimeter sign. Signage indicating "Notice: Now leaving the Tornado Shelter," or "Notice: Now leaving the Hurricane Shelter," shall be installed inside of the storm shelter, adjacent to every door or alcove/baffled entry system which access non-protected areas located outside of the storm shelter.

504.1.3 Shelter directional signs. Signage is required within a facility to direct occupants to storm shelter areas.

~~**504.1.2 Identifying sign.** A sign depicting the general location of the storm shelter area(s) and accessways shall be displayed in all of the following location:~~

~~1. Adjacent to access doors on the inside of the storm shelter;~~
~~2. In the office of the facility manager, where provided; and~~
~~3. In the designated shelter manager's area within the storm shelter, where provided.~~

~~**504.1.2.1 Location of identifying sign.** The identifying sign shall be posted in a prominent location 60 inches (1524 mm) above the finished floor to the centerline of the sign.~~

504.2 Design information. All shelters shall have a sign on or within the shelter with the name of the manufacturer or builder of the shelter and the storm type(s) and respective design wind speed(s).

Committee Reason: Modification to change title of section to Signage is editorial. Modification is to move existing text for directional signage from 504.1 to 504.1.3 to follow format of proposal. Work Group 5 to develop proposal for directional signage.

The committee agreed with the reasoning from the work group. What signs are required should be clearly identified in one location. The signs for outside the shelter (entry), inside the shelter (leaving protection) and directional are for community shelters. The design information is for all shelter, and should be located on/in all shelters for the information of the occupants. Leave labeling in Section 108. The identifying sign is administrative/operational and not needed in this section. (Identifying sign should be included in operational chapter currently under development.)

The ICC A117.1 provides technical criteria for size of letters based on viewing distance and requirements for high contrast. If this is a permanent room designation, the tactile (raised letter and braille) is a separate sign that is address in the IBC/A117.1.

IS-STM 05-09-18

IS-STM 05-09-18		**Committee action: Approval as Modified**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**14**	**1**	**0**	**0**	**1**

Staff Notes: errata

508.1 Signage requirements. *Community storm shelter* areas shall be marked by signage in accordance with Sections ~~508.2 through 508.4~~ 508.1.1 through 508.1.5. All storm shelters shall be marked with design information in accordance with Section 508.2 ~~508.5~~. The signs shall comply with the visual character requirements of ICC A117.1.

508.2 ~~508.5~~ Design information. All *storm shelters* shall have a sign on or within the *storm shelter* with all of the following:

1. The *storm shelter occupant load.*
2. The storm type.
3. The *storm shelter design wind speed*.
4. The edition of the ICC 500 used for the design.
5. The name of the manufacturer or builder of the *storm shelter*.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Levitan Vote:		**x**		

Your comment/reason:

a. is 508.1.3 directional signage 'within a facility' needed? Doesn't the combination of 508.1.4 (within a host building) and 508.1.5 (for a multi-building site) cover everything intended by 508.1.3? 508.1.3 isn't very clear anyway – if there is something not covered by the other two, please be more specific, otherwise delete 508.1.3.

b. In previous sections, we talk about shelters for general public versus either specific use or building occupants (see my earlier comments on terminology inconsistencies). Suggest explicitly using those same terminologies here in sections 508.1.3 (if keeping), and 508.1.4 an 508.1.5, so connect the dots.

c.Need a new subsection for shelters for the general public, and that section needs to indicate signage visible from main entry to parking lot or building, directing people to which entrance to use.

Revise as follows:

~~**508.1.3** *Storm* ***shelter*** **directional signs.** Signage is required within a facility to direct occupants to *storm shelter* areas.~~

508.1.3 Storm shelter exterior signage. Where a storm shelter is for public use, directional signage shall be proved at the site arrival points and at the building entrances indicating the direction of travel.

508.1.4 *Storm shelter* directional signage within a *host building*. Where a *storm shelter* is within a *host building*, directional signage is required within the *host building* to direct intended occupants to the *storm shelter*. The path of travel to the *storm shelter* shall be clearly marked to indicate the direction of travel in cases where the path of travel is not immediately visible to the intended occupants.

508.1.5 *Storm shelter* directional signage for a multi building site. Where a *storm shelter* serves multiple buildings, directional signage is required to direct intended occupants to the *storm shelter*.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason:
05-15-18 replaced 508.1.3 with 508.1.4 and 508.1.5. Section 508.1.3 is not needed. Move the requirements for all shelters to the beginning of the section. Reorder rest of section as indicated.

Revise as follows:

SECTION 508
SIGNAGE

508.1 Signage requirements. ~~*Community storm shelter* areas shall be marked by signage in accordance with Sections 508.2 through 508.4.~~ All storm shelters shall be marked with design information in accordance with Section 508.2 ~~508.5~~. *Community storm shelter* areas shall be marked by signage in accordance with Sections 508.3 through 508.6. ~~The~~ All signs shall comply with the visual

character requirements of ICC A117.1.

508.2 ~~508.5~~ Design information. All *storm shelters* shall have a sign on or within the *storm shelter* with all of the following:

1. The *storm shelter* ~~*occupant load*~~ *design occupant capacity*.
2. The storm type.
3. The *storm shelter design wind speed*.
4. The edition of the ICC 500 used for the design.
5. The name of the manufacturer or builder of the *storm shelter*.

508.3 ~~508.1.4~~ *Storm shelter* directional signage within a *host building*. Where a *storm shelter* is within a *host building*, directional signage is required within the *host building* to direct intended occupants to the *storm shelter*. The path of travel to the *storm shelter* shall be clearly marked to indicate the direction of travel in cases where the path of travel is not immediately visible to the intended occupants.

508.4 ~~508.1.5~~ *Storm shelter* directional signage for a multi building site. Where a *storm shelter* serves multiple buildings, directional signage is required to direct intended occupants to the *storm shelter*.

508.5 ~~508.1.1~~ Shelter entry sign Signage indicating "Tornado Shelter," or "Hurricane Shelter," or and appropriate symbols as applicable, shall be installed outside the *storm shelter*, adjacent to every door or *alcove or baffled storm shelter entry system* intended to provide entry into the *storm shelter*.

508.6 ~~508.1.2~~ *Storm shelter* perimeter sign. Signage indicating "Notice: Now leaving the Tornado Shelter," or "Notice: Now leaving the Hurricane Shelter," shall be installed inside of the *storm shelter*, adjacent to every door or *alcove or baffled storm shelter entry system* which access non-protected areas located outside of the *storm shelter*.

~~**508.1.3 *Storm shelter* directional signs.** Signage is required within a facility to direct occupants to *storm shelter* areas.~~

IS-STM 05-18-18
ICC 500 Sections 202, 104.2, 107.2.1, 501.2, 703.1, 703.4

Proponent: ICC 500

Revise as follows:

~~STORM SHELTER OCCUPANT LOAD. The occupant load intended for a room or space when that space is in use as a storm shelter.~~

DESIGN CAPACITY, STORM SHELTER. The number of occupants for which the storm shelter is designed.

STORM SHELTER. A building, structure or portion~~(s)~~ thereof, constructed in accordance with this standard, designated for use during a severe wind storm event such as a hurricane or tornado.

Community Storm Shelter. Any *storm shelter* not defined as a *residential storm shelter*.

Residential Storm Shelter. A *storm shelter* serving occupants of dwelling units and having ~~an occupant load~~ a storm shelter design capacity not exceeding 16 persons.

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~~ a storm shelter design capacity 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.*

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: Residential or community 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 wind exposure category (indicate all if more than one is used).
5. The internal pressure coefficient, GC_{pi}.
6. The topographic factor, K_{zt}.
7. The directionality factor, K_d.
8. A statement that the shelter has/has not been constructed within an area susceptible to flooding in accordance with Chapter 4 of this standard.
9. The Design Flood Elevation and Base Flood Elevation for the site (if applicable).
10. 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.

11. A floor plan drawing or image indicating location of the storm shelter on a site or within a building or facility; including a drawing or image indicating the entire facility.
12. 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. The lowest shelter floor elevation and corresponding datum, except for residential shelters outside of special flood hazard areas.
14. The ~~occupant load~~ storm shelter design capacity of the storm shelter.
15. The usable storm shelter floor area.
16. Venting area (square inches) provided and locations in the shelter.
17. Calculations for the number of sanitation facilities for community shelters.
18. Minimum foundation capacity requirements.
19. Shelter installation requirements, including anchor location and minimum required capacity for each anchor.
20. For hurricane shelters, the rainfall rate of the roof primary drainage system.
21. For hurricane shelters, the rainfall rate of the roof secondary (overflow) drainage system where required.
22. For hurricane shelters, the rainwater drainage design rainfall rate for facilities subject to rainwater impoundment.

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 *storm shelters*, the number of means of egress doors shall be determined in accordance with the *applicable* building *code* based upon the ~~occupant load~~ storm shelter design capacity 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: *Storm shelters* having ~~an occupant load~~ a storm shelter design capacity not exceeding 16 are not required to have an emergency escape opening.

703.1 Ventilation. Every occupied space in community hurricane shelters with ~~an occupant load~~ a storm shelter design capacity of 50 or greater ~~than 50~~ shall be ventilated by mechanical means in accordance with Section 703.1.1. All hurricane shelters shall be provided with natural ventilation in accordance with Section 703.1.2.

703.4 Emergency lighting. Community hurricane shelters shall be provided with an emergency lighting system. The emergency lighting system shall provide an average of 1 foot-candle of illumination (11 lux) in occupied shelter areas, occupant support areas, required corridors, passageways and means of egress.

Exception: Personal-use flashlights shall be permitted for the emergency lighting system requirement for hurricane shelters with ~~an occupant load~~ a storm shelter design capacity less than ~~or equal to~~ 50, when provided at a quantity not less than one (1) flashlight per 10 occupants. Personal-use flashlights shall be a minimum of two “D” cell size or equivalent light output, and readily accessible from within the occupied shelter areas or immediately adjacent occupant support areas.

Reason: There are two purposes to this proposal.

First, the change in terminology is to make sure that the higher number of occupants in the shelter is address separately from the normal occupant load of the space.

There is some confusion with the use of the term occupant load that this is as defined by the IBC in regards to egress. The design capacity of a storm shelter has nothing to do with fire egress or posted occupant loads.

The 2015 IBC Commentary states:
"Once the number of occupants to be accommodated is decided, ICC 500 provides details for the design and construction of the shelter."
"It is not the intent to require the shelter to be designed for the total occupant load of the building that is used for means of egress."

For Group E occupancies the number of occupants a storm shelter is required to be designed for (423.4.1 Required occupant capacity) is determined per language in the IBC. For other occupancy types or where the IBC does not apply there are no requirements for the number of occupants, an owner can determine this number on anything they wish. When using the occupant density tables in chapter 5 of the ICC 500 we then determine the required and provided usable shelter floor area.

Should be noted this term "STORM SHELTER OCCUPANT LOAD" doesn't actually appear anywhere else in the ICC 500 standard other than the definition. The term "occupant load" does appear multiple times and would have to be reviewed if a change is required for each instance.

Second to make sure the cut offs at 16 and 50 are all the same. Residential shelters are 16 or fewer. Shelter used for homes but with more than 16 occupants are community shelters.
The cut off in the IBC for two exits from a room is less than 50. The current text in the ICC 500 is inconsistent. They have been reworded to all be less then 50/50 or more.

The following are new sections previously approved by the committee that include 'occupant load' and the 16 and 50 cut offs..

(IS-STM 01-28-18- AM)
107.1 Storm shelters requiring *peer review*. A *peer review* shall be conducted for the following *storm shelter* types:

1. *Community storm shelters* with ~~an~~ *a storm shelter design capacity* ~~*occupant load*~~ greater than 50.
2. *Storm shelters* in elementary schools, secondary schools and day care facilities with ~~an~~ *a storm shelter design capacity* ~~*occupant load*~~ greater than 16.
3. *Storm shelters* in Risk Category IV (essential facilities) as defined in Table 1604.5 in the *International Building Code.*

(IS-STM 05-03-18 AM)
USEABLE STORM **SHELTER FLOOR AREAS.** The portions of the floor area within the *storm shelter envelope* not including *occupant support areas*, used to determine the maximum *storm shelter design capacity* ~~*occupant load*~~ of the *storm shelter*.

(IS-STM 07-13-18 AM, IS-STM 07-17-18 AM)
~~**702.3**~~ **702.4** ~~**Emergency**~~ **Standby lighting.** *Community tornado shelters* shall be provided with an ~~emergency~~ standby lighting system. The ~~emergency~~ standby lighting system shall provide ~~an average~~ illumination levels of not less than 1 foot-candle (11 lux) ~~of illumination~~ at the walking surface in *occupied storm shelter areas*~~,~~ and *occupant support areas*~~, required corridors,~~

~~passageways and means of egress~~. The standby lighting system shall be connected to a standby power system.

Exception: Personal-use flashlights shall be permitted for the standby lighting system requirement for tornado shelters with ~~an occupant load~~ a storm shelter design capacity of less than 50 ~~or less~~, when provided at a quantity not less than one (1) flashlight per 10 occupants. Personal-use flashlights with a minimum of 150 lumens or an approved equivalent lighting device, and readily available within the *occupied storm shelter areas* or immediately adjacent *occupant support areas*.

Committee Action: As modified (8-0)

Further modify the proposal as follows:

DESIGN OCCUPANT CAPACITY, STORM SHELTER. The number of occupants for which the storm shelter is designed.

Note: Change in each location used.

Committee Reason: Agree with reason statement. Add 'occupant' in definition for additional clarity.

IS-STM 05-18-18

STM 05-18-18		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**13**	**2**	**0**	**0**	**1**
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Erhlich Vote:		**x**		

Your comment/reason: IS-STM 01-16-18 intended to clarify the occupant load of the storm shelter required to be provided as part of the design information on the construction documents is the "maximum designed". IS-STM 05-18-18 introduced the term "storm shelter design occupant capacity" and implemented the term throughout ICC-500, creating an unnecessarily redundant reference in Item #16 of 106.2.1 to the "maximum designed…design…capacity".

Revise as follows:

106.2.1 Design information. *(portions not shown remain unchanged)*
16. The maximum ~~designed~~ *storm shelter design occupant capacity*.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:		**x**		

Your comment/reason: In the definition of Storm Shelter Design Occupant Capacity, it does not state how the number of occupants is derived or the basis of determining that number, therefore designers could still have the problem of AHJ's interpreting this as the occupant load as required by IBC Ch 10. Secondly, without some basis of determining the capacity, an owner could have a gym sized shelter and claim to have an design capacity of 100 occupants therefore all the support systems would be designed for 100 when in fact the owner is actually planning on 1000.

No suggested revision.

DESIGN OCCUPANT CAPACITY, STORM SHELTER. The number of occupants for which the storm shelter is designed.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason:
Chapter 5 chapter 5 determines occupant density and usable square footage - the occupant capacity is determined by IBC for Group E or pre-determined by owner.

No suggested revision. Highlight is for emphasis.

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

Exceptions:

1. Where the facility has a *storm shelter design occupant capacity* 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.*
2. Where the facility is a *residential storm shelter*, the designated occupancy shall be the Group R occupancy served as defined by the *International Building Code.*

IS-STM 05-19-18
ICC 500 Chapter 5

Proponent: ICC 500

Revise as follows:

CHAPTER 5

~~OCCUPANCY,~~ OCCUPANT DENSITY, ~~MEANS OF EGRESS,~~ ACCESS, ~~AND~~ ACCESSIBILITY, EMERGENCY EGRESS AND SIGNAGE

SECTION 501
GENERAL

501.1 Scope. The requirements of this chapter shall govern the occupant density, access, accessibility emergency egress and signage for storm shelters.

SECTION ~~501~~ 502
OCCUPANCY DENSITY IN COMMUNITY STORM SHELTERS

502.1 ~~501.1~~ General. A community storm shelter shall comply with the requirements ~~of this section~~ of Section 502.2 through 502.4. ~~A residential shelter shall comply with the requirements of Section 502.~~

502.2 ~~501.1.1~~ Occupant density. The minimum required community storm shelter floor area per occupant shall be determined in accordance with Table ~~501.1.1~~ 502.2, and ~~this section~~ Sections 502.3. The number and type of occupants served by the storm shelter ~~standing, seated, wheelchair or bedridden spaces~~ shall be determined based upon the needs of the storm shelter as determined by the applicable authority having jurisdiction and the designer.
~~501.1.3 Wheelchair spaces.~~ Each storm shelter shall be sized to accommodate a minimum of one wheelchair space for every 200 storm shelter occupants or portion thereof.

Table 502.2 ~~501.1.1~~
OCCUPANT DENSITY – COMMUNITY STORM SHELTERS

~~TYPE OF SHELTER~~ TYPE OF OCCUPANTS	MINIMUM REQUIRED *USABLE STORM SHELTER FLOOR AREA*~~[a]~~ IN SQUARE FEET PER OCCUPANT
Tornado	
Occupants who are Standing or seated	5
Occupants using a Wheelchair	10
Occupants who are relocated in a bed or stretcher ~~Bedridden~~	30
Hurricane	
Occupants who are Standing or seated	20
Occupants using a Wheelchair	20
Occupants who are relocated in a bed or stretcher ~~Bedridden~~	40

For SI: 1 square foot = 0.0929 m^2.
~~a. See Section 501.1.2 for requirements for minimum required usable shelter floor area.~~

502.3 ~~501.1.2~~ *Usable storm shelter floor area*. The *usable storm shelter floor area* shall be determined by Section ~~501.1.2.1 or 501.1.2.2~~ 502.3.1, 502.3.2 or a combination of these methods.

502.3.1 ~~501.1.2.1~~ Calculation of usable storm shelter floor area. The *usable storm shelter floor area* shall be determined by using the following percentages:

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

502.3.2 ~~501.1.2.2~~ Alternative calculation of usable floor area. The *usable storm shelter floor area* shall be determined by subtracting from the gross floor area, the floor area partitions and walls, columns, fixed or movable objects, furniture, equipment or other features that under probable conditions cannot be removed.

SECTION 503 ~~502~~
OCCUPANT DENSITY IN RESIDENTIAL STORM SHELTERS

503.1 ~~502.1~~ General. A *residential storm shelter* shall comply with the requirements ~~of this section~~ of Section 503.1 through 503.3 . ~~A community shelter shall comply with the requirements of Section 501.~~

503.2 ~~502.4~~ Occupant density. The minimum required *usable storm shelter floor area* per occupant for *residential storm shelters* shall be determined in accordance with Table ~~502.4~~ 502.2 and 503.3.

TABLE 503.2 ~~502.4~~
OCCUPANT DENSITY—*RESIDENTIAL STORM SHELTERS*

~~TYPE OF SHELTER~~ TYPE OF OCCUPANTS	MINIMUM REQUIRED *USABLE STORM SHELTER FLOOR AREA* IN SQUARE FEET PER OCCUPANT
Tornado	
One- and two-family dwelling	3
Other residential	5
Hurricane	
One- and two-family dwelling	7
Other residential	10

For SI: 1 square foot = 0.0929 m^2.

503.3 ~~502.4.1~~ Usable ~~tornado~~ storm shelter floor area. The *usable* ~~tornado~~ *storm shelter floor area* shall be ~~the gross floor area, minus the area of sanitary facilities, if any, and shall include the protected occupant area between the shelter walls at the level of fixed seating, where fixed seating exists~~ determined by subtracting from the gross floor area, the floor area partitions and walls, columns, fixed or movable objects, furniture, equipment or other features that under probable conditions cannot be removed.

SECTION 504
ACCESS AND EMERGENCY EGRESS IN COMMUNITY SHELTERS

504.1 General. A community storm shelter shall comply with the access and egress requirements of Section 504.2 through 504.5.

504.2 ~~501.6~~ Accessibility ~~Accessible route.~~ Buildings and space used as community storm shelters shall be accessible in accordance with the applicable code. ~~Shelters shall be provided with an accessible route in accordance with ICC A117.1.~~

504.3 Wall and roof openings. All access openings, means of egress doors, emergency escape openings and overhead hatches in the storm shelter envelope shall comply with the design and testing requirements in Section 306.3.

504.4 ~~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 from the storm shelter, the storm shelter shall also provide for emergency egress by an emergency escape opening ~~shall be provided~~ in accordance with Section ~~501.4~~ 504.5 or an overhead hatch accessed by an emergency stair, ladder or alternating tread device in accordance with Section 506.

Exception: *Storm shelters* having an ~~occupant load~~ *storm shelter design occupant capacity* not exceeding 16 are not required to have an emergency escape opening.

504.4.1 ~~501.3~~ Direction of swing. The direction of the swing of doors shall be as required by the *applicable* ~~building~~ *code* for the normal occupancy of the space.

504.4.2 ~~501.5~~ Door operation. Means of egress doors shall be operable from the inside without the use of keys or special knowledge or effort.

504.5 ~~501.4~~ Emergency escape opening. The emergency escape opening shall be an additional door or an opening that ~~is~~ complies with the following:

1. Have a minimum net clear opening of 5.7 square feet (0.530 m^2) ~~in area~~.
2. ~~Such opening shall~~ Have a minimum net clear opening height of 24 inches (610 mm) and a minimum net clear opening width of 20 inches (508 mm).
3. ~~The emergency escape~~ ~~opening~~ Shall be operable from the inside without the use of tools or special knowledge.
4. Where the bottom of the clear ~~emergency escape~~ opening is located more than 44 inches (1117.6 mm) above the ~~finished~~ floor ~~level~~, vertical access to the opening shall be provided by ~~a~~ an emergency stair complying with Section ~~502.3.1~~ 506.2 or a ladder complying with Section ~~502.3.2~~ 506.3, or an alternating tread device complying with Section ~~502.3.3~~ 506.4.
   ~~The emergency escape opening shall be located away from the means of egress door by a minimum distance of one-third of the length of the maximum overall diagonal dimension of the area to be served.~~
   Exception: The minimum net clear opening shall be permitted to be 5 square feet where the bottom of the emergency escape opening is not more than 44 inches (1118 mm) above or below finished grade.

~~**501.4.1 Ladders for community shelters.** Ladders for community shelter, which are required for access to emergency escape openings above the level of normal egress, shall comply with the requirements of Section 502.3.2. When the access opening is located on a vertical surface (see Section 305.2.1), the height of the opening shall be not less than 30 inches (762 mm).~~

SECTION 505
ACCESS AND EMERGENCY EGRESS IN RESIDENTIAL STORM SHELTERS

505.1 General. A residential storm shelter shall comply with the access and egress requirements of Section 505.2 through 505.3.

505.2 Wall and roof openings. All access openings, means of egress doors and overhead hatches in the storm shelter envelope shall comply with Section 306.3.

505.3 Entry and egress. The residential storm shelter shall be provided with a method of entry and egress by a means of egress door, an access opening complying with Section 505.3.2 or an overhead hatch complying with Section 506.5.

505.3.1 ~~502.5~~ Door operation. Means of egress doors shall be operable from the inside without the use of keys or special knowledge or effort.

~~502.2~~ 505.3.2 Access openings. ~~All residential shelters~~ Access openings shall be ~~provided with a method of entry and egress with minimum~~ a clear opening ~~dimensions~~ of 24 inches by 30 inches (610 mm by 762 mm) minimum.

505.4 ~~502.3~~ Vertical access. Where ~~required~~ provided, vertical access to a residential storm shelter shall be by an emergency stair complying with Section ~~502.3.1~~ 506.2, or by a ladder complying with Section ~~502.3.2~~ 506.3, or an alternating tread device complying with Section ~~502.3.3~~ 506.4.

SECTION 506
VERTICAL ACCESS

506.1 General. Where stairways are required for means of egress for normal use of the space, they shall comply with the applicable code. An emergency stair shall comply with Section 506.2. A ladder shall comply with Section 506.3, An alternating tread device shall comply with Section 506.4. Overhead hatches shall comply with Section 506.5.

506.2 ~~502.3.1~~ Emergency stairs ~~for *residential shelters*~~. Emergency stairs shall comply with all of the following:

1. Treads shall have a minimum depth of 8 inches (203 mm).
2. Treads shall not be required to have a nosing.
3. Surfaces or treads shall be slip resistant.
4. The maximum height of risers shall be $9^{9}/_{16}$ inches (243 mm).
5. The minimum width of the emergency stairs shall be 22 inches (559 mm).
6. The angle of the emergency stair from horizontal shall be a maximum of 50 degrees (0.87 rad).

~~Treads for emergency stairs in *residential shelters* shall have a minimum depth of 8 inches (203 mm). The maximum height of risers shall be $9^{9}/_{16}$ inches (243 mm). Surfaces of steps shall be slip resistant. The minimum width of stairs shall be 22 inches (559 mm). The angle of the stairway emergency stair from horizontal shall be a maximum of 50 degrees (0.87 rad). Stairs shall be constructed such that a foot is prevented from sliding off either side of the stairway. Stair Treads shall not be required to have a nosing.~~

Exception: ~~The maximum height of risers~~ For *residential storm shelters*, which have a ~~maximum~~ rise between the *storm shelter* floor level and *storm shelter* entrance level of 70 inches (1778 mm) maximum, the maximum height of risers shall be 10 inches (254 mm) ~~for 8-inch (203 mm) stair treads~~.

506.2.1 ~~502.3.1.1~~ ~~Overhead clearance~~ Headroom. The minimum headroom clearance ~~above any stair tread to an overhead obstruction~~ shall be ~~6 feet 8~~ 80 inches (2032 mm), measured vertically ~~above the leading edge of the tread~~ from a line connecting the edge of the nosing.

Exceptions:

1. The minimum ~~overhead~~ headroom clearance is permitted to be reduced to ~~5 feet~~ 60 inches (1524 mm) where signage is provided at the top and bottom of the emergency stair conspicuously warning the user of low headroom.

2. Entrances that are entered by persons seated on the entrance threshold and that are not high enough for a person to enter standing erect shall not be required to provide minimum headroom clearance provided that there is no more than two ~~stair~~ risers leading into the *storm shelter*.

506.2.2 ~~502.3.1.2~~ ~~Stair~~ Handrails. A continuous handrail shall be located on one side of ~~a stairway~~ an emergency stair having more than three risers. Handrail extensions are not required.

506.3 ~~502.3.2~~ Ladders ~~for residential shelters.~~ Ladders shall comply with the all of following:

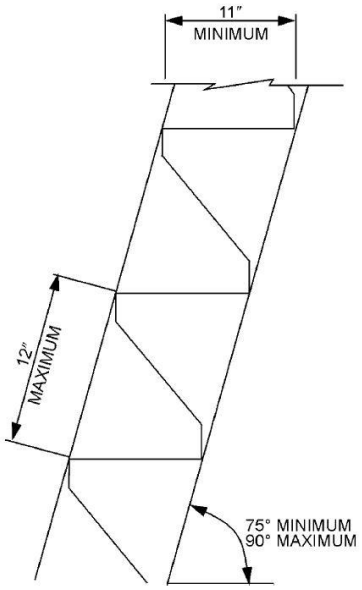
1. The clear width between rails shall be not less than 16 inches (406 mm).
2. Rungs shall be a minimum of 3/4 inch (19 mm) in diameter.
3. Rungs or treads shall be capable of withstanding a 300 pound (136 kg) load.
4. Rungs or treads shall be spaced uniformly at not greater than 12 inches (305 mm).
5. The minimum clearance between the centerline of the rungs or treads to the nearest permanent object in back of the ladder on the toe side shall be no less than 7 inches (178 mm).
6. Ladders shall have a maximum slope of 90 degrees (1.57 rad) from horizontal and a minimum slope of 75 degrees (1.31 rad) from horizontal where measured on the toe side of the ladder.

~~The clear length of rungs for ladders shall be not less than 16 inches (406 mm). Rungs shall be constructed such that a foot cannot slide off the end of the rung. Ladder rungs shall be a minimum of 3/4 inch (19 mm) in diameter and shall be spaced uniformly at not greater than 12 inches (305 mm).~~

~~Ladder wells or cages shall have a minimum of 15 inches (381 mm) clear on either side of the centerline of the ladder and a minimum of 27 inches (686 mm) clear from the centerline of the rungs to a ladder well or cage on the climbing side of the ladder. Where obstructions occur in the ladder well, this distance shall be increased to 30 inches (762 mm).~~

~~The distance between the centerline of the rungs or steps to the nearest permanent object in back of the ladder (on the toe side) shall be no less than 7 inches (178 mm). Ladders shall have a maximum slope of 90 degrees (1.57 rad) from horizontal and a minimum slope of 75 degrees (1.31 rad) from horizontal where measured on the toe side of the ladder.~~

Exception: ~~No~~ A minimum clearance is not required on the back side of the ladder where there is no obstruction on the climbing side of the ladder, and where ladder ~~steps~~ treads of 11 inches (279 mm) or greater in ~~width~~ depth are molded or fabricated in a continuous series of treads and risers ~~in which the foot can neither slip through the riser nor be trapped by the riser or next higher ladder stair tread~~. ~~The maximum slope shall be 90 degrees (1.57 rad) from horizontal and the minimum slope shall be 75 degrees (1.31 rad) from horizontal. See~~ as detailed in Figure ~~502.3.2~~ 505.3.



For SI: 1 inch = 25.4 mm, 1 degree = 0.0174 rad.

FIGURE 502.3.2

FIGURE ~~502.3.2~~ 505.3
Alternative for a ladder in a *storm* ***shelter***

506.3.1 ~~502.3.2.1~~ Ladder ~~Cages or~~ wells. Ladder ~~cages or~~ ladder wells, ~~shall be~~ where provided ~~for vertical climbs extending more than 8 feet (2438 mm).~~ shall have a minimum of 15 inches (381 mm) clear on either side of the centerline of the ladder and a minimum of 27 inches (686 mm) clear from the centerline of the rungs to a ladder well or obstruction on the climbing side of the ladder.

506.4 ~~502.3.3~~ Alternating tread devices ~~for residential shelters~~. Alternating tread devices ~~for residential shelters~~ shall comply with the applicable requirements listed in the ~~*International Building Code*~~ applicable code.

~~**502.3.3.1 Overhead clearance.** The minimum clearance requirements for stairs (including exceptions) listed in Section 502.3.1.1 shall also apply to alternating tread devices.~~

506.5 ~~502.3.2.2~~ Overhead hatches. Where provided, hatches at the tops of emergency stairs, ladders or alternating tread devices shall ~~have~~ comply with the following:

1. A minimum clear dimensions of 24 inches by 30 inches (610 mm by 762 mm).
2. A clear opening of 24 inches (610 mm) minimum from the ~~centerline~~ the face of the top tread or rung of the emergency stairs, ladders or alternating tread devices on the climbing side ~~of the ladder~~ and
3. A minimum of 15 inches (372 mm) on either side of the centerline of the top tread or rungs ~~shall be provided.~~
4. Where the access opening is located on a vertical surface in accordance with Section 305.2, the height of the opening shall be 30 inches (762 mm) minimum.
5. Hatches shall open a minimum of 60 degrees (1.04 rad) from the closed position.
6. Hatches shall be counterweighted or otherwise held in the open position when opened.

SECTION 507 ~~503~~
~~LOCKS AND~~ LATCHING

507.1 ~~503.1~~ Latching mechanisms. Latching mechanisms for *impact-protective systems* shall be permanently mounted on the assembly. Such mechanisms shall require no tools to be engaged in the latched position. Devices such as pins shall be permanently secured to the assembly through the use of chains or wires that must be of corrosion-resistant material.

~~503.3 Door latches.~~ ~~Door~~ Latching ~~hardware~~ mechanism necessary for ~~the~~ *impact-protective systems* ~~door assembly~~ to perform as designed for the *storm shelter* shall ~~either~~ comply with either of the following:

1. Automatically engage ~~when~~ where the ~~door~~ impact protective system is in a closed position and shall not be capable of being disabled~~, or~~.
2. Be capable of being engaged by an occupant. Signage shall be provided with instructions for latching the ~~door~~ *impact-protective systems* for ~~emergency~~ *storm shelter* use.

507.2 ~~503.2~~ Multi-latching systems. Multi-latching systems for *impact-protective systems* that are not categorized as a means of egress~~/escape~~ and are provided with more than one single-action latching mechanism shall be provided with permanently posted instructions on the latching.

SECTION 508 ~~504~~
SIGNAGE ~~FOR *COMMUNITY SHELTERS*~~

508.1 ~~504.1~~ Signage requirements. *Community storm shelter* areas shall be marked by signage in accordance with ~~this section~~ Sections 508.2 through 508.4. All storm shelters shall be marked with design information in accordance with Section 508.5. ~~Signage is required within a facility to direct occupants to storm shelter areas.~~

Reason: The main purpose of this revision is to improve the organization of the chapter. There are also clean ups in the text. The reference in this reason are the new section numbers.

These two new sections will be relocated/further revised as follows:

(IS-STM 05-03-18 AM) (IS-STM 05-17-18 AM)
502.4 ~~501.1.3~~ *Tornado Shelter* Usable floor area. In *community tornado shelters* the following *occupant support areas* shall be permitted to be considered *usable storm shelter floor area*;

1. Where the entire *storm shelter* is a single occupant toilet room area~~.~~
2. Where the *storm shelter* includes multi-stall toilet rooms, the toilet room area other than the toilet stalls and temporary toilet station~~s~~ privacy areas provided to meet the requirements for toilet stations in Section 702.2. The *usable storm shelter floor area* shall be calculated by Section ~~501.1.1, 501.1.3.2~~ 502.3.1, 502.3.2, or a combination of these methods.

Note: The last sentence or 502.4 is redundant with 502.3. This will be addressed in public comments.

(IS-STM 05-05-18 AM)
504.6 ~~501.6~~ Multi-story shelter. *Storm s*helters with multiple stories shall be required to have one emergency means of vertical access provided within the storm shelter to a level of exit discharge provided by a ~~stairway~~ emergency stair complying with Section ~~502.3.1~~ 506.2 or a ladder complying with Section ~~502.3.2~~ 506.3, or an alternating tread device complying with Section ~~502.3.3~~ 506.4.

The general organization is:

- Section 501 is a general scoping section.
- Section 502 and 503 are occupant density for community and residential storm shelters, respectively.

- Section 504 and 505 are access and egress for community and residential storm shelters, respectively.
- Section 506 are the vertical access options of emergency stairs, alternating tread devices or ladders and associated overhead hatches.
- Section 507 is latching for impact protective devices.
- Section 508 is signage requirements.

Some of the general fixes – 'this section' is replaced with specific references. The work group compared the language between community and residential shelter requirements and made revisions where different words were used to mean the same thing. There was an effort to make the language consistent for the emergency stair, ladder and alternating tread devices – as well as for part of those devices.

The title of Chapter 5 is revised for follow the language and the order of the chapter requirements.

501.1 – This is a general scoping section for the chapter.

502.1 –The 2nd sentence is not needed. This is addressed in Section 503.

502.2 – The language in the text and table are coordinated and clarified for number and type of occupants served. The current Section 501.1.3 is part of the shelter size requirements.

503.1 – The 2nd sentence is not needed. This is addressed in Section 502.

503.2 -The language in the text and table are coordinated and clarified for number and type of occupants served.

503.3 – The language is revised for coordination with the terminology in Section 502.3.2.

504.1 – This is scoping for the new section for access and egress for community shelters.

504.2 – There is much more to accessibility addressed in the code than just the accessible route (e.g. toilet rooms or doors within the shelter). In addition, the current text (501.6) is just to the technical criteria in ICC A117.1, not the scoping/where requirements in IBC.

504.3 – This is a pointer for impact protection for all access and egress openings.

504.4 – The IBC now specifies an occupancy for dedicated storm shelters, so the last sentence of the first paragraph can be deleted. The new pointer in the 2nd paragraph allows for single exit spaces to use an emergency escape opening out of a wall of access to a roof hatch with an emergency stair, alternating tread device or ladders.

504.5 – The revisions clarify that this size is the opening, not the size of the window. This is also coordinated with similar clarifications in the IBC. The IBC allows for grade floor emergency escape and rescue opening sizes to be reduced to 5 square feet for basements and first

floors. If this exception is not added, there could be a conflict with the IBC and IRC where the emergency escape and rescue opening required for fire, is the same opening as required for a shelter.

Existing 501.4.1 – this text for ladders is included in 506.5.

505.1 - This is scoping for the new section for access and egress for residential shelters.

505.2 – This is a pointer for impact protection for all access and egress openings.

505.3 – The language is for clarification of the options for access into and out of a residential shelter.

506 – The vertical access requirements have been moved out from under residential shelter requirement so that they can be generally referenced. Since the requirements in ICC 500 allow for narrower and steeper stairways to access roof hatches than permitted in the IBC or IRC for means of egress. Therefore, the name for these devices are emergency stairs, and the text was revised throughout to use that term. If the stairway is the normal stairway for means of egress, it has to comply with the applicable code.

506.2 – the requirements for emergency stairs has been put in a list. The exception is for the riser height. Since there is no change to the tread, it does not have to be included in the exception.

506.2.1 – 'Headroom' is a more universal term. The language for measurement is consistent with what is in IBC for stairways.

506.3 – The ladder requirements in paragraph 1 and 3 have been put in a list, similar to emergency stairways. The language regarding "foot sliding off the end of the rung" is removed because there is no clear and consistent interpretation on how that would be done. The strength (300 lbs.) for the rungs was added for consistency with the IMC requirements for ladders. The 2nd paragraph is moved to the requirement for ladder wells in Section 506.3.1. In the exception, the phrase "in which the foot can neither slip through the riser nor be trapped by the riser or next higher ladder stair tread" is removed because there is no clear and consistent interpretation on how that would be done other than the "fabricated in a continuous series" which is in the requirements. This should be added into commentary. The last sentence is not needed because is it in the list of requirements and is therefore not needed in the exception.

506.3.1 – Ladder well requirements are moved to one section.

506.4 – the applicable code is consistent with references throughout the standard.

502.3.3.1 is removed because the overhead clearance requirement are in the applicable codes.

506.5 – The additional sentence was relocated from existing 501.4.1, which is being deleted. Section 305.3 says vertical is surfaces inclined 30 degrees or more from the horizontal.

507 – there are no requirements for locks, so this has been removed from the title. The section was revised to clarify that these requirements are for latching mechanisms for impact protective systems.

508.1 – since the requirements in this section are not for both community and residential shelters, there is new scoping language. The whole section will be renumbered.

Committee Action: As submitted (10-0)

Committee Reason: See reason.

IS-STM 05-19-18

IS-STM 05-19-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	11	4	0	0	2
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Erhlich Vote:		x		

Your comment/reason: Editorial fix – missing comma between accessibility and emergency egress.

Revise as follows: (errata)

501.1 Scope. The requirements of this chapter shall govern the occupant density, access, accessibility, emergency egress and signage for storm shelters.

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Manley Vote:		x		

Your comment/reason: In Section 501.1, there is a comma missing between "accessibility" and "emergency" – "shall govern the occupant density, access, accessibility, emergency egress and signage".

Also, in Section 503.2 (Clean Draft) reference is made to Table 503.3. I believe it should be Table 503.2.

Revise as follows: (errata)

501.1 Scope. The requirements of this chapter shall govern the occupant density, access, accessibility,

emergency egress and signage for storm shelters.

503.2 Occupant density. The minimum required *usable floor area* per occupant for *residential storm shelters* shall be determined in accordance with Table 503.2 ~~503.3~~ and Section 503.3.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Roeper Vote:		**x**		

Your comment/reason: The wording of 507.2 would be improved by the following nonsubstantive change;

Revise as follows:

507.2 Multi-latching systems. Impact-protective systems not categorized as a means of egress and utilizing multi-latching systems ~~Multi-latching systems for *impact-protective systems* that are not categorized as a means of egress and are provided~~ with more than one single-action latching mechanism shall have permanently posted instructions on the latching operation.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:		**x**		

Your comment/reason: *503.3-Add the word "of" between "area" and "partitions".*

Revise as follows:

503.3 Usable tornado storm shelter floor area. The *usable storm shelter* floor area shall be determined by subtracting from the gross floor area, the floor area of partitions and walls, columns, fixed or movable objects, furniture, equipment or other features that under probable conditions cannot be removed.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason:

a. Add commas

Revise as follows: (errata)

501.1 Scope. The requirements of this chapter shall govern the occupant density, access, accessibility, emergency egress, and signage for storm shelters.

b.Insert ",and 502.4" after 502.3. Delete "applicable".

Revise as follows:

502.2 Occupant density. The minimum required community storm shelter floor area per occupant shall be determined in accordance with Table 502.2, and Sections 502.3 and 502.4. The number and type of occupants served by the storm shelter shall be determined based upon the needs of the storm shelter as determined by the ~~applicable~~ authority having jurisdiction and the designer. Each storm shelter shall be sized to accommodate a minimum of one wheelchair space for every 200 storm shelter occupants or portion thereof.

c.Clarification. Section 504.4.2 is already addressed in the IBC.

Revise as follows:

504.4 Egress Doors. The size, number, configuration and direction of swing of means of egress doors ~~from a space~~ in the storm shelter envelope shall be determined based upon the occupant load for the normal occupancy of the space in accordance with the *applicable code*. The number of doors shall also comply with Section 603.

~~Where the *applicable code* requires only one means of egress door from the storm shelter, the storm shelter shall also provide for emergency egress by an emergency escape opening in accordance with Section 504.5 or an overhead hatch accessed by an emergency stair, ladder or alternating tread device in accordance with Section 506.~~ Storm shelters with a design occupant capacity between 16 and 50 shall have an additional egress door, emergency escape opening, or overhead hatch.

~~**Exception:** *Storm shelters* having an *storm shelter design occupant capacity* not exceeding 16 are not required to have an emergency escape opening.~~

~~**504.4.1 Direction of swing.** The direction of the swing of doors shall be as required by the *applicable code* for the normal occupancy of the space and in accordance with the manufacturer's listing.~~

~~**504.4.2 Door operation.** Means of egress doors shall be operable from the inside without the use of keys or special knowledge or effort.~~

d. Look at use of entry vs access and use consistent term.

Revise as follows:

505.3 ~~Entry~~ Access and egress. The residential storm shelter shall be provided with a method of ~~entry~~ access and egress by a means of egress door, an access opening complying with Section 505.3.2 or an overhead hatch complying with Section 506.5.

e.Delete this pointer, not necessary.

Revise as follows:

~~**505.4 Vertical access.** Where provided, vertical access to a residential storm shelter shall be by an emergency stair complying with Section 506.2, or by a ladder complying with Section 506.3, or an alternating tread device complying with Section 506.4.~~

f.Change Section title

Revise as follows:

Section 506
Vertical Access and Egress

g. Replace this section as follows:

Revise as follows:

~~**506.1 General.** Where stairways are required for means of egress for normal use of the space, they shall comply with the applicable code. An emergency stair shall comply with Section 506.2. A ladder shall comply with Section 506.3, An alternating tread device shall comply with Section 506.4. Overhead hatches shall comply with Section 506.5.~~

506.1 General. Vertical access for emergency egress shall be provided within the storm shelter to a level of exit discharge egress door or to an emergency escape opening or overhead hatch by an emergency stair or a ladder or an alternating tread device complying with Section 506.2, 506.3 or 506.4 as applicable. Where stairs are required for means of egress for normal use of the space, they shall comply with the applicable code. Overhead hatches shall comply with Section 506.5.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Woestman PC:		**x**		

Your comment/reason: "Emergency egress" is a newly introduced term in the standard and used only in Chapter 5. The standard does not describe or define how emergency egress is different than egress (if it is different). Searching through the ballot edition of the standard, the only specific requirement for emergency egress is in the second paragraph of (revised number) Section 504.4. The use of "emergency egress" in this context appears to be an appropriate use of this term. However, all other uses of "emergency egress" raise the question as to what is meant by emergency egress, rather than answer that question. In addition, these uses of "emergency egress" do not provide guidance as to what is required or prohibited regarding emergency egress.

We suggest the standard would be improved by deleting “emergency” from “emergency egress” in all locations in the standard except Section 504.4. The standard would also be improved with a modification in (revised number) Section 504.2, as proposed below: inserting an explicit requirement to comply with egress requirements of the applicable code.

Revise as follows:

CHAPTER 5
OCCUPANT DENSITY, ACCESS, ACCESSIBILITY, ~~EMERGENCY~~ EGRESS, AND SIGNAGE

501.1 Scope. The requirements of this chapter shall govern the occupant density, access, accessibility, ~~emergency~~ egress, and signage for storm shelters.

SECTION 504
ACCESS AND ~~EMERGENCY~~ EGRESS IN COMMUNITY SHELTERS

504.2 Egress and Accessibility. Buildings and space used as community storm shelters shall comply with egress requirements and be accessible in accordance with the applicable code.

SECTION 505
ACCESS AND ~~EMERGENCY~~ EGRESS IN RESIDENTIAL STORM SHELTERS

Your comment/reason: This proposed revision is intended to improve understanding of the intent and requirements of the revised standard. The standard requires all door openings in the storm shelter envelope to be protected with an impact-protective system. However, it should be noted not all doors in the storm shelter envelope would be required to be an impact-protective system.

For example, the requirements of the standard should be able to be satisfied if a door opening in the storm shelter envelope utilizes two swinging door assemblies (much like many homes in Northern climates have a storm door and an insulated door in the same door opening). The outer door assembly could be the impact-protective system (such a heavy-duty steel mesh in a stout frame) while the inner door provides the design pressure performance required (remember, an inswing door has some advantages regarding design pressure requirements because the required negative design pressure is usually higher than the required positive design pressure). Of course, this example may be applicable only where doors of this configuration comply with all other applicable code requirements.

Regardless of the example above, the proposed revision clarifies that the requirement for a door to be installed in accordance with the manufacturer’s listing (as an impact-protective system) applies only where the door is in the storm shelter envelope and is a (required) impact-protective system.

By separating the door swing requirement from the installation requirement of the impact-protective system, and by inserting the proposed text, the intent of the proposed revisions is explicitly clarified.

Further modify the standard as follows:

504.4.1 Direction of swing. The direction of the swing of doors shall be as required by the *applicable code* for the normal occupancy of the space ~~and in accordance with the manufacturer's listing~~.

504.4.1.1 Door installation. Doors in the storm shelter envelope shall comply with Section 504.4.1 and where required to be an impact-protective system, the door shall be installed in accordance with the door manufacturer's listing as an impact-protective system.

Chapter 6
FIRE SAFETY

IS-STM 06-04-18
ICC 500 Section 601.1

Proponent: Marc Levitan, representing ICC 500 Committee

Revise as follows:

SECTION 601
FIRE-RESISTANT CONSTRUCTION

601.1 Fire separation. ~~Fire barriers and horizontal assemblies~~ Walls, floors and ceilings separating spaces or areas designated as community storm shelters from other building areas shall have a minimum fire-resistance rating of 2 hours and shall be constructed in as fire barriers or horizontal assemblies in accordance with the applicable building code.

~~Exception:~~ ~~Fire separation assemblies are not required for residential shelters~~. Fire-resistant opening protectives are not required where the opening is protected in accordance with Section 306.

Reason: This is in the proposals as a result of the failed committee interpretation last round to Section 601. See IS-STM 03-12-18, 06-02-18, 06-03-18, 06-04-18.

What needs to be considered is if the purposes/intent for fire resistance and storm shelters are not compatible. The tornado and hurricane shelters are to defend occupants in place during a major storm event. The fire resistance requirements from the building code are to limit the fire spread out of a room, or protection of exits for occupant evacuation.

There are practical considerations why a shelter cannot be designed for both events. If there is a fire during a storm event, occupants cannot stay in place because of the lack of oxygen. The fire takes the oxygen. Fire evacuation routes may no longer be readily available due to storm damage to the building. Given that this storm shelter is utilized during a large scale event, the emergency responders are not available for everyone either.

The current text in Section 601.1 is not clear. The 2014 ICC 500 committee could not agree on an interpretation of this requirement. Is the intent of Section 601.1 that if there is a separation required by the building code for separating uses or incidental areas, and it is also the wall of a shelter, it has to be at least two hours? Or is the idea that a storm shelter should always be separated by a two hour fir resistance rating? In either case, what is the justification for 2 hours? The building code required 2 hour protection for stairways that connect 4 or more stories.

This option is that fire resistance rated walls and horizontal assemblies are required for the walls and floor/ceiling of a shelter at all times. In these situations baffle entries and natural ventilation would not be permitted through the rated assemblies, since this would apply even to stand-alone shelters and exterior walls of shelters. Openings through the fire rated assemblies would have to meet both fire resistance and as well as impact and pressure tests. If this section is limited to community shelters, you don't need the current exception.

Without the exception there would be in direct conflict with the ICC 500 sections dealing with opening protectives and fire rated walls. With the allowances for baffled entries in Sections 306.3 and 804.9.7, door undercuts in Section 306.7 and other penetrations in Section 309.1, there seems to be an allowance for allowing shelter opening that could not meet the requirements for fire protected openings. If you are not going to allow these options why are they in the standard at all?

Committee Action: Approved as modified (11-0)

Replace with the following:

SECTION ~~601~~ 603
FIRE-RESISTANT CONSTRUCTION

~~**601.1 Fire separation.** *Fire barriers* and horizontal assemblies separating spaces or areas designated as *storm shelters* from other building areas shall have a minimum fire-resistance rating of 2 hours and shall be constructed in accordance with the *applicable* building *code*.~~

~~**Exception:** Fire separation assemblies are not required for *residential shelters*.~~

603.1 Fire separation. Walls or horizontal assemblies between *community storm shelters* and other host building areas shall be *fire barriers* or *horizontal assemblies* with a minimum fire-resistance rating of 2 hours constructed in accordance with the applicable building code.

Exceptions: Fire barriers and horizontal assemblies are not required for storm shelters with any of the following configurations:

1. The design occupant capacity of 16 or fewer.
2. The storm shelter is located in the basement or underground, the design occupant capacity is 49 or fewer, two doors are provided and the doors are separated by a minimum horizontal distance equal to 1/3 of the overall diagonal dimension of the storm shelter.
3. The design occupant capacity is 49 or fewer and the additional egress door, overhead hatch or emergency escape opening opens directly to the exterior of the building.
4. The means of egress is designed in accordance with the applicable building code for the design occupant capacity for the storm shelter, the storm shelter has at least two means of egress doors and at least at 50 percent of the total required capacity for the means of egress from the storm shelter is directly to the exterior of the building.

603.1.1 Doors and shutters. Where the applicable building code does not require a rated assembly, fire rated doors and shutters serving the *community storm shelter* are not required to be self or automatic closing where the opening is protected in accordance with Section 306.

SECTION 306
COMPONENT DESIGN AND TESTING

306.1 Shelters meeting tornado impact test requirements. Shelter envelope components meeting missile impact test requirements for tornado shelters shall be considered acceptable for hurricane shelters provided they meet structural design load requirements for hurricane shelters.

306.2 Shelter fire resistance. Shelter envelope components shall be fire-resistance rated in accordance with Section 603 and the applicable code.

SECTION 501
COMMUNITY SHELTERS

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. The number of doors shall also comply with Section 603.

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

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. Ventilation openings that penetrate the storm shelter envelope between the host building and storm shelter shall also comply with the provisions of Section 603.

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. Ventilation openings that penetrate the storm shelter envelope between the host building and storm shelter shall also comply with the provisions of Section 603.

803.5 Fire-resistance testing. The testing for fire-resistance materials required by Section 603 and pressure and impact tests in accordance with Chapter 8 shall be subjected to such tests separately. Testing on a separate specimen for fire resistance shall be permitted.

SECTION 804
MISSILE IMPACT TESTING

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~~ that comply with one of the following:

1. Storm debris impacts at least two impact-protective systems 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 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 804.9.7.2. Examples of this type of system are shown in Figures 804.9.7.1 and 804.9.7.2.
3. Storm debris impact on an entry door is limited to an angle less than 90 degrees (1.57 rad) by impact-protective systems. The debris test requirements for this type of system are presented in Section 804.9.7.3. Examples of this type of system are shown in Figure 804.9.7.3.

804.9.7.1 Alcove/baffled entry systems for which no testing is required. Shelter entrances, whether provided with a door or not, that are protected by an alcove or baffled entry system that require missiles to impact at least two surfaces meeting the requirements of Section 306.2 prior to arriving at the protected occupant area shall not be required to undergo debris impact testing. See Figure 804.9.7.1. When a solid door is installed as a closure for this type of entry system or to meet the fire-resistance requirements in Section 603, the door need not meet the wind load requirements of Section 304.

804.9.7.2 Door subject to rebound impact. Where the alcove or baffled entry system prevents a first impact of the design missile on the door but the door is subject to a rebounded impact of the design missile after it has impacted one surface meeting the requirements of Section 306.2 (see Figure

804.9.7.2), then a door assembly shall meet the wind load requirements of Section 304 and the debris impact requirements of Section 305 except that the missile shall be, at a minimum, a 9-pound sawn lumber 2 by 4 traveling at 50 feet per second (15.2 m/s). Entry systems having doors that are protected from the initial and first rebounded impacts of debris shall comply with the requirements of Section 804.9.7.1.

804.9.7.3 Door subject to first impact. If a first-strike angle missile impact on the door is possible (see Figure 804.9.7.3) then the door is deemed suitable if the door assembly meets the wind load requirements of Section 304, the fire-resistance requirements of Section 603, and the door assembly meets one of the following debris impact criteria:

1. The door withstands the impact of a missile specified in Section 305 striking the door assembly at an angle closest to perpendicular to the plane of the door that the missile might strike in the shelter application~~; or~~.
2. The door assembly is tested following procedures specified in Section 305 or a door assembly is selected that has withstood missile impacts by the design missile striking perpendicular to the surface with speed equal to or greater than the shelter design missile's velocity component perpendicular to the door assembly for the most critical angle that can occur in the application.

The minimum debris impact criterion for the door shall be an impact perpendicular to the door of a 9-pound sawn lumber 2 by 4 traveling at 50 feet per second [34 mph (15.2 m/s)].

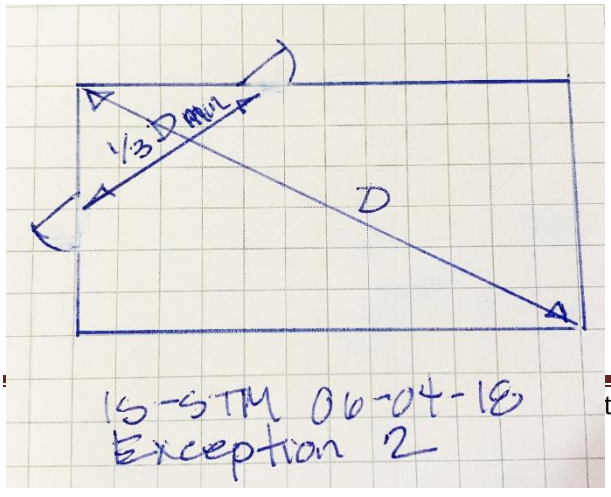
Committee Reason: The intent is to protect shelter occupants from the possibility of a fire in the host building. The provisos provide clarity on the fire resistance requirements for the shelter envelope, including opening protectives. The exceptions are intent to provide a compromise to balance passive fire protection and additional options for emergency egress of occupants. The exceptions, item 4 in particular, could alleviate some of the technical problems with retrofitting shelters into existing buildings. The changes to the rest of the standard are pointers for the fire resistance requirements.

The purpose of the fire barrier between a community shelter and the host building is to protect shelter occupants from a possible fire in the host building. At this time there are no reported incidents of fires occurring that have injured or killed shelter occupants.

The exceptions are options for shelter design that would allow for the shelter occupants to have additional exits, so that they can leave the shelter faster if there ever is a fire event.

Exception 1 is allowing for community shelters that are the same size as residential shelters.

Exception 2 and 3 are for shelters that would be required to have only one exit door. This would decrease the changes of the only exit being blocked. Exception 2 asks for a 2nd door with the same separation requirements as required in the codes. Exception 2 asks for a



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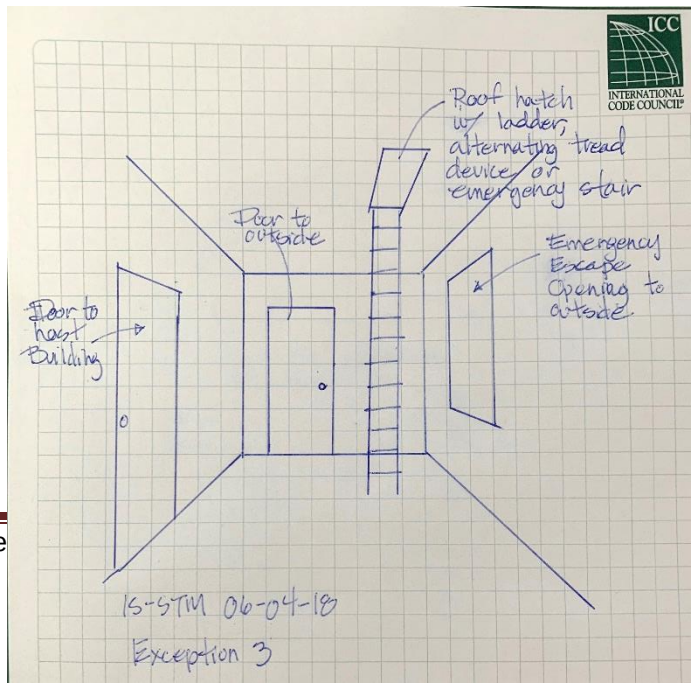


2nd door, a escape opening or a roof hatch that took occupants to the outside. (Current text allows the emergency escape or hatch in a single exit shelter, but does not require egress to the outside.) Moving to the outside would help protect occupants from smoke.

Exception 4 is for large facilities – this would typically require more doors and or wider doors. This requirement will always get at least one door directly to the outside.

Average school size for states varies from 178 (Montana) to 711 (Nevada)
Assuming an addition 10% for staff = 782 for average school -
https://www.publicschoolreview.com/average-school-size-stats/national-data
Assuming sprinklered buildings so 0.15" width per occupant for capacity

Example 1:
Tornado shelter size for # of occupants-
778 shelter occupants x 5 sq.ft. per person + 4 shelter occupants x 10 sq.ft. per wheelchair space = 3930 sq.ft.
Normal use and exits –
3930/20 sq.ft. = 197 occupant classroom – 2 doors with single 3'-0" doors
3970/50 sq.ft. = 79 occupant gym – 2 doors single 3'-0" doors
3970/15 sq.ft = 264 occupant cafeteria – 2 doors single 3'-0" doors
Shelter exits –
782 occupants - 3 exits with 3'-4" doors (40" width each)

Hurricane shelter size for # of occupants-
778 shelter occupants x 10 sq.ft. per person + 4 shelter occupants x 10 sq.ft. per wheelchair space = 7820 sq.ft.
Normal use and exits –
7820/20 sq.ft. = 391 occupant classroom – 2 doors with single 3'-0" doors
7820/50 sq.ft. = 156 occupant gym – 2 doors single 3'-0" doors
7820/15 sq.ft = 521 occupant cafeteria – 3 doors with single 3'-0" doors
Shelter exits –
782 occupants - 3 exits with 3'-4" doors (40" width each)

Example 2:
According to the designers on the call – large shelters are 2,000 occupants.
Tornado shelter size for # of occupants-
1980 shelter occupants x 5 sq.ft. per person + 20 shelter occupants x 10 sq.ft. per wheelchair space = 10,100 sq.ft.
Normal use and exits –
10,100/20 sq.ft. = 505 occupant classroom – 3 doors with single 3'-0" doors
10,100/50 sq.ft. = 202 occupant gym – 2 doors single 3'-0" doors
10,100/15 sq.ft = 673 occupant cafeteria – 3 doors with 3'-0" doors
Shelter exits –
2000 occupants - 4 exits with double 3'-2" doors (75" width each)

Hurricane shelter size for # of occupants-
1980 shelter occupants x 10 sq.ft. per person + 20 shelter occupants x 10 sq.ft. per wheelchair space = 20,000 sq.ft.
Normal use and exits –
20,000/20 sq.ft. = 1000 occupant classroom – 4 doors with 3'-2"doors (38" each)
20,000/50 sq.ft. = 400 occupant gym – 2 doors single doors
20,000/15 sq.ft = 1,334 occupant cafeteria – 4 doors with double doors (50" width each)
Shelter exits –
2,000 occupants - 4 exits with double 3'-2" doors (75" width each)

IS-STM 06-04-18

IS-STM 06-04-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	12	1	2	0	3
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		

Your comment/reason: Editorial revision to 306.2 for consistent use of term *storm shelter*. Editorial revision to 802.5 so it does not literally read "the testing…shall be subjected to such tests separately."

Revise as follows:

306.2 Storm shelter ~~Shelter~~ fire resistance. *Storm shelter* ~~Shelter~~ envelope components shall be fire-resistance rated in accordance with Section 603 and the applicable code.

802.5 Fire-resistance testing. Materials required to have fire tests for compliance with the ~~The testing for~~ fire-resistance ratings ~~materials~~ required by Section 603 and pressure and impact tests in accordance with Chapter 8 shall be subjected to such tests separately. Testing on a separate specimen for fire resistance shall be permitted.

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:			x	

Your comment/reason:
While I do not agree with any of the separation requirements beyond minimums already in the building code, I understand there are wide differences of opinion here and thus the proposed text is a compromise. However, the Section 603.1 basement/underground exception 2 in particular is far too restrictive. Until the last few decades, taking refuge below ground has always been the main solution for tornado shelters. Consider for example a large university or municipal building with a basement below the entire structure. That would be a great location for a large capacity storm shelter, but would not fit within the current exceptions.

Remember, not only does the CDC not have any records of fire-related injuries or fatalities in storm shelters during or following storms.

Revise as follows:

603.1 Fire separation. Walls or horizontal assemblies between *community storm shelters* and other host building areas shall be *fire barriers* or *horizontal assemblies* with a minimum fire-resistance rating of 2 hours constructed in accordance with the applicable code.

Exceptions: Fire barriers and horizontal assemblies are not required for storm shelters with any of

the following configurations:

1. The design occupant capacity of 16 or fewer.
2. The storm shelter is located in the basement or underground, ~~the design occupant capacity is 49 or fewer, two doors are provided~~ has at least one means of egress more than the minimum number required by the applicable code, ~~and the doors~~ and at least two means of egress are separated by a minimum horizontal distance equal to 1/3 of the overall diagonal dimension of the storm shelter.
3. The *storm shelter design occupant capacity* is less than 50 and the additional egress door, overhead hatch or emergency escape opening opens directly to the exterior of the building.
4. The means of egress is designed in accordance with the applicable ~~building~~ code for the *storm shelter design occupant capacity*, the storm shelter has at least two means of egress doors and at least at 50 percent of the total required capacity for the means of egress from the storm shelter is directly to the exterior of the building.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Reoper Vote:			**x**	

Your comment/reason: As written the section is not worded properly and does not address fire protection rated material.

Revise as follows:

802.5 Fire-~~resistance~~ testing. The ~~testing for~~ specimens of fire-resistance or fire-protection materials required by Section 603 and pressure and impact tests in accordance with Chapter 8 shall be permitted to be subjected to such tests separately. ~~Testing on a separate specimen for fire resistance shall be permitted.~~

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC		**x**		

Your comment/reason: Add “storm”

Revise as follows:

306.1 Storm Shelter fire resistance. *Storm Shelter envelope* components shall be fire-resistance rated in accordance with Section 603 and the *applicable code*.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Holstein PC:		**x**		

Your comment/reason: Envelope components on the exterior of the shelter do not need to be fire-resistance rated, residential storm shelters are outside the scope of 603 and don’t need to be fire-

resistance rated. In its current wording, 306.2 could be misconstrued to require all components to be fire-resistance rated, which is not accurate.

Revise as follows:

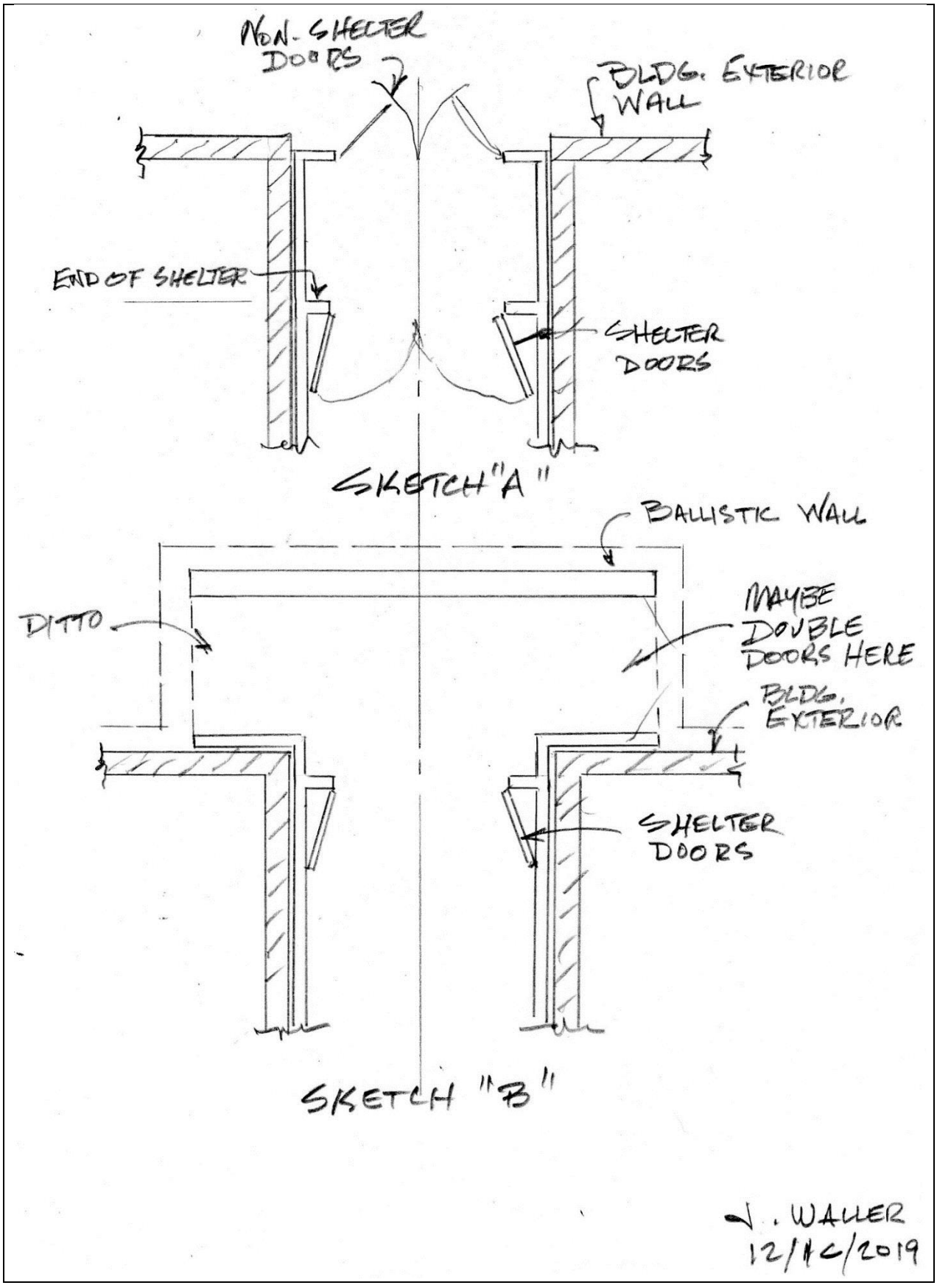
306.2 Shelter fire resistance. Shelter envelope components shall be fire-resistance rated ~~in accordance with~~ where required by Section 603 and the applicable code.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Waller PC:		**x**		

Your comment/reason:

I am submitting as a public comment the following comments/questions with respect to the proposed Section 603.1 Fire separation, Exception 4.

1. The exception requires "…egress from the storm shelter is directly to the exterior of the building." I am requesting that the committee clarify the definition of the exterior of the building for the following reasons:
    - a) Where a storm shelter exits directly to the exterior of the building, but has non-shelter doors for normal egress and has tornado doors recessed from the end of the shelter as shown in attached Sketch A, does the shelter meet Exception 4? The double tornado doors are only closed for maintenance, tornado drills, or actual events; the non-shelter doors are used at all other times. The egress would be similar to a baffled entry in that the protected shelter envelope would extend to the exterior wall.
    - b) The corridor of a storm shelter exits directly to the exterior of the building as shown in Sketch B. A ballistic wall protects the corridor. If the shelter walls and roof extend over the ballistically-protected alcove as shown in Sketch B, and the ballistic wall is part of the storm shelter, does the shelter meet Exception 4?
    - c) For Sketch B, if non-shelter egress doors are installed at the two ends of the alcove, does the shelter meet Exception 4?
2. Public storm shelters constructed within a host building may have dual uses which involve regular paths of egress requiring entry doors for security and protection from weather, dust, wind, etc. The heavy storm doors would be recessed from the entry doors and held in an open position except when required to be closed for storm activity. The entryway between the entry doors and the storm doors would be dedicated path of egress and would be of sufficient length to protect the steel storm doors from weather during normal use of the building.
3. I am requesting that the commentary for Section 603.1 clarify these issues.



No suggested revisions.

603.1 Fire separation. Walls or horizontal assemblies between *community storm shelters* and other host building areas shall be *fire barriers* or *horizontal assemblies* with a minimum fire-resistance rating of 2 hours constructed in accordance with the applicable code.

Exceptions: Fire barriers and horizontal assemblies are not required for storm shelters with any of the following configurations:

1. The design occupant capacity of 16 or fewer.
2. The storm shelter is located in the basement or underground, the *storm shelter design occupant capacity* is less than 50, two doors are provided and the doors are separated by a minimum horizontal distance equal to 1/3 of the overall diagonal dimension of the storm shelter.
3. The *storm shelter design occupant capacity* is less than 50 and the additional egress door, overhead hatch or emergency escape opening opens directly to the exterior of the building.
4. The means of egress is designed in accordance with the applicable code for the *storm shelter design occupant capacity*, the storm shelter has at least two means of egress doors and at least at 50 percent of the total required capacity for the means of egress from the storm shelter is directly to the exterior of the building.

Chapter 7
SHELTER ESSENTIAL FEATURES AND ACCESSORIES

IS-STM 07-01-18
ICC 500 Section 202, 701.1, 703.6, 703.8.3

Proponent: Crystal Wespestad, representing self

Revise as follows:

SECTION 202 DEFINITIONS

~~**CRITICAL SUPPORT SYSTEMS.** Structures, systems and components required to ensure the health, safety and well-being of occupants. Critical support systems include, but are not limited to, potable and waste water systems, electrical power systems, life safety systems and HVAC systems.~~

~~**SECTION 701 GENERAL**~~

~~**701.1 Protection of critical support systems.** Critical support systems shall remain functional for the design storm event and minimum period of shelter occupancy (24 hours for hurricane shelters, 2 hours for tornado shelters). Critical support systems located outside of the storm shelter areas shall be protected by a means that meets the wind pressure and missile impact requirements of Chapter 3, and, as applicable, the flood-resistance requirements of Chapter 4.~~

SECTION 703
HURRICANE SHELTERS

703.6 Standby power. Community hurricane shelters with a shelter occupant load greater than 50 shall be provided with a standby electrical power system. The standby electrical power system shall support occupied hurricane shelter areas~~,~~ and occupant support areas ~~and critical support systems~~. At a minimum, the standby electrical power system shall supply power to life safety systems and critical branch lighting circuits. Where required by the authority having jurisdiction, the standby electrical power system shall also supply power to selected HVAC circuits.

703.8.3 Rainwater drainage for hurricane shelter facilities. Rainwater drainage shall be provided for hurricane shelter facilities where it is possible that rainwater will be

impounded and flood occupied shelter areas~~, critical support systems~~ occupant support areas 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.

Reason: The definition of critical support systems could be read to include the plumbing, sprinkler, alarm and HVAC systems for the entire building. That is the purview of the building codes. The scope of this standard is the shelter. If the wind has blown away part of the roof for the building, you cannot guarantee that any of the systems outside the shelter will remain in place. Section 701.1 should be removed as outside the scope of the standard – and not possible to guarantee during the storm – that is why you have a shelter!

Section 703.6 and 703.8.3 are the other two sections where this defined term is uses. Again, the scope of the standard is the shelter. If you limit the application to the shelter, the term is not used in the standard. Therefore the term should be removed.

Staff note: See IS-STM 02-02-18, 06-01-18 and 07-01-18 for changes to critical support system.
Critical support system is used in ICC 500 in Section 107.3.1, 701.1, 703.6, 703.8.3

Committee Action: As Modified (8-0)

Replace with the following:

CRITICAL SUPPORT SYSTEMS, STORM SHELTER. ~~Structures,~~ Systems and components required to ensure the health, safety and well-being of shelter occupants. Critical support systems include~~, but are not limited to,~~ potable and waste water systems, ~~electrical~~ emergency and standby power and lighting systems~~, life safety systems~~ and ~~HVAC~~ ventilation systems.

SECTION 701
GENERAL

701.1 Protection of storm shelter critical support systems. Storm shelter critical support systems shall remain functional for the design storm event and minimum period of shelter occupancy (24 hours for hurricane shelters, 2 hours for tornado shelters). Storm shelter Critical support systems located outside of the storm shelter areas shall be protected by a means that meets the wind pressure and missile impact requirements of Chapter 3, and, as applicable, the flood-resistance requirements of Chapter 4.

SECTION 602
FIRE PROTECTION SYSTEMS

602.1 Fire protection system. Fire protection systems shall be provided within the storm shelter where required by the applicable code for the normal use of the space. These systems are not required to be functional or to be protected when the space is occupied as a storm shelter (24 hours for hurricane shelters, 2 hours for tornado shelters) from the wind pressure and missile impact requirements of Chapter 3 or the flood-resistance requirements of Chapter 4.

SECTION 703
HURRICANE SHELTERS

703.6 Standby power. Community hurricane shelters with a shelter occupant load greater than 50 shall be provided with a standby electrical power system. The standby electrical power system shall support occupied hurricane shelter areas, occupant

support areas and storm shelter critical support systems. At a minimum, the standby electrical power system shall supply power to life safety systems and critical branch lighting circuits. Where required by the authority having jurisdiction, the standby electrical power system shall also supply power to selected HVAC circuits.

703.8.3 Rainwater drainage for hurricane shelter facilities. Rainwater drainage shall be provided for hurricane shelter facilities where ~~it is possible that~~ rainwater will be impounded and flood occupied shelter areas, occupant support areas and storm shelter 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.

Committee Reason: *The revisions to the definition clarify that the critical support systems protection is only for the shelter, not the entire building. Revisions to Section 703.8.3 include occupant support areas in rainwater protection. A new section in Chapter 6 will clarify that while a sprinkler system may be required by the IBC, it is not expected that this building system is to remain operational during the event.*

Below is what has been approved for these sections at this time. The work group is asking for reconsideration of IS-STM 07-02-18, because with this clarification, the new exception to Section 701.1 is not needed and could be confusing.

(IS-STM 07-02-18 – AM)

701.1 Protection of *critical support systems*. *Critical support systems* shall remain functional for the design storm event and minimum period of *storm shelter* occupancy (24 hours for *hurricane shelters*, 2 hours for *tornado shelters*). *Critical support systems* located outside of the *storm shelter* areas shall be protected by a means that meets the wind pressure and missile impact requirements of Chapter 3, and, as applicable, the flood-resistance requirements of Chapter 4.

Exception: The requirements of this section shall not apply to automatic fire sprinkler systems and fire alarm systems.

(IS-STM 07-13-18 AM)

703.6 Standby power. Where required by Section 703.1 or 703.4, *Community hurricane shelters* ~~with a shelter occupant load greater than 50~~ shall be provided with a standby ~~electrical~~ power system. The standby ~~electrical~~ power system shall support occupied ~~hurricane~~ *storm shelter* areas~~,~~ and *occupant support areas* ~~and critical support systems~~. ~~At a minimum, the standby electrical power system shall supply power to life safety systems and critical branch lighting circuits. Where required by the authority having jurisdiction, the standby electrical power system shall also supply power to selected HVAC circuits.~~

(IS-STM 03-04-18-AFM, IS-STM 07-16-18 AS, IS-STM 10-05-18 AM)

703.8.3 Rainwater drainage for *hurricane shelter* facilities. Rainwater drainage shall be provided for *hurricane shelter* facilities where ~~it is possible~~ that rainwater will be impounded and flood *occupied storm 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 100-year, 1-hour rainfall rate. The 100-year, 1 hour rainfall rate shall be determined from Figure ~~303.2~~ 303.1.1 or from approved local weather data.

IS-STM 07-01-18

IS-STM 07-01-18		**Committee action: Approval as Modified**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**15**	**0**	**0**	**0**	**1**

Staff Notes:

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason: AHJ/FM may have issue with this sounding like systems can be disabled.

Revise as follows:

602.1 Fire protection system. Fire protection systems shall be provided within the storm shelter where required by the applicable code for the normal use of the space. These systems are not required to ~~be functional or to~~ be protected when the space is occupied as a storm shelter (24 hours for hurricane shelters, 2 hours for tornado shelters) from the wind pressure and missile impact requirements of Chapter 3 or the flood-resistance requirements of Chapter 4.

IS-STM 07-03-18
ICC 500 Section 702.1, 702.1.2, 703.1, 703.1.1

Proponent: Marc Levitan, representing the ICC 500 committee

Revise as follows:

SECTION 702
TORNADO SHELTERS

702.1 Ventilation. Occupied space in tornado shelters shall be ~~ventilated by natural means~~ provided with natural ventilation in accordance with Section 702.1.1 or ~~by~~ with mechanical ventilation in accordance with Section 702.1.2. Openings used for atmospheric pressure change (APC) are permitted to be counted as ventilation for the purposes of this section. Ventilation openings for natural and mechanical ventilation shall comply with Section 702.1.3 and 702.1.4.

702.1.1 Natural ventilation. Tornado shelters that rely on natural ventilation shall be provided with the minimum ventilation area in accordance with Table 702.1.1.

TABLE 702.1.1
VENTING AREA REQUIRED FOR TORNADO SHELTERS

TORNADO SHELTER TYPE	VENTING AREA (PER OCCUPANT)
Residential	2* square inches
Community (≤50 occupants)	5 square inches
Community (> 50 occupants)	6 square inches

* See exception to Section 702.1.1.1.
For SI: 1 square inch = 645.2 mm^2.

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 on an opposite wall or the roof surface to provide cross ventilation of the shelter.

Exception: Air intake openings for residential tornado shelters shall be permitted to be located entirely in the upper half of the shelter provided that the venting area is increased to 4 square inches (1290 mm^2) per shelter occupant.

702.1.2 Mechanical ventilation. Tornado shelters that rely on mechanical ventilation shall be provided with the minimum mechanical ventilation rate of required outdoor air in accordance with the applicable building code provisions for the normal use of the space. The mechanical ventilation system shall be connected to ~~an emergency~~ a standby power system.

702.1.3 Intake openings. Outside air intake openings located in the same wall shall be located a minimum of 10 feet (3048 mm) horizontally and separated from any hazardous or noxious contaminant, such as emergency or back-up generator vents or exhaust, fuel storage tank vents and containers, maintenance or custodial storage facilities.

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.

SECTION 703
HURRICANE SHELTERS

703.1 Ventilation. ~~Every occupied~~ Occupied space in community hurricane shelters with an occupant load greater than 50 shall be ventilated by mechanical means in accordance with Section ~~703.1.1~~ 703.1.2. All hurricane shelters shall be provided with natural ventilation in accordance with Section ~~703.1.2~~ 703.1.1. Ventilation openings for natural and mechanical ventilation shall comply with Section 703.1.3 and 703.1.4.

703.1.1 ~~703.1.2~~ Natural ventilation. All shelters shall be provided with openings to facilitate minimum natural ventilation in accordance with this section. The area of ventilation openings shall comply with Table 703.1 and the location of openings shall be in accordance with Section 703. Where hurricane shelters are also designed as tornado shelters, openings provided to relieve internal pressure for atmospheric pressure change (APC) per Section 304.7 shall be permitted to be counted as natural ventilation openings.

TABLE ~~703.1~~ 703.1.1
VENTING AREA REQUIREMENTS FOR HURRICANE SHELTERS

SHELTER TYPE	VENTING AREA (PER OCCUPANT)
Residential	4 square inches
Community (≤50 occupants)	8 square inches
Community (> 50 occupants)	12 square inches

For SI: 1 square inch = 645.2 mm^2.

~~703.1.3~~ 703.1.1.1 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 on an opposite wall or the roof surface to provide cross ventilation of the shelter.

703.1.2 ~~**703.1.1**~~ **Mechanical ventilation.** The minimum mechanical ventilation rate of required outdoor air shall be determined in accordance with the applicable building code provisions for the normal use of the space. The mechanical ventilation system shall be connected to a standby power system.

703.1.3 ~~**703.1.4**~~ **Intake openings.** Outside air intake openings located in the same wall shall be located a minimum of 10 feet (3048 mm) horizontally and separated from any hazardous or noxious contaminant, such as emergency or back-up generator vents or exhaust, fuel storage tank vents and containers, maintenance or custodial storage facilities.

703.1.4 ~~**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.

Reason: The terminology and order of requirements for natural and mechanical ventilation are inconsistent between the tornado and hurricane shelter. The purpose of this proposal is to coordination.

- Section 702.1 – Use the defined term and to be consistent with Section 703.1. The requirements for the opening locations and impact protection needs to be referenced.
- Section 702.1.2 – Ventilation systems are on standby power, not emergency power.
- Section 703 – The order of the requirements is changed to be consistent with tornado shelters.
- Section 703.1 – "Every" is redundant and not good code text. The requirements for the opening locations and impact protection needs to be referenced
- Section 703.1 .2 – Section 703.1 requires mechanical ventilation in large tornado shelters. It seems consistent to require that system to remain in operation, even if there is also natural ventilation.

Committee Action: As Modified (8-0)

Further modify as follows:

703.1.1 Natural ventilation. All shelters shall be provided with openings to facilitate minimum natural ventilation in accordance with this section. The area of ventilation openings shall comply with Table 703.1.1 and the location of openings shall be in accordance with Section 703.1.1.1. Where hurricane shelters are also designed as tornado shelters, openings provided to relieve internal pressure for atmospheric pressure change (APC) per Section 304.7 shall be permitted to be counted as natural ventilation openings.

Committee Reason: The modification is a correction to referenced sections. This is an editorial reorganization. The proposal is a clarification and adds consistency of type of power for ventilation in tornado and hurricane shelters.

IS-STM 07-03-18

IS-STM 07-03-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	13	2	0	0	0

Staff Notes: errata.

703.5 Ventilation. Occupied space in *community hurricane shelters* with a *storm shelter design occupant capacity* of 50 or greater shall be ventilated by mechanical means in accordance with Section ~~703.1.2~~ 703.5.2. All *hurricane shelters* shall be provided with *natural ventilation* in accordance with Section ~~703.1.1.~~ 703.5.1. Ventilation openings for natural and mechanical ventilation shall comply with Section ~~703.1.3 and 703.1.4~~ 703.5.3 and 703.5.4.

703.5.1 ~~703.5.1.1~~ *Natural ventilation*. All *hurricane shelters* shall be provided with openings to facilitate minimum *natural ventilation* in accordance with this section. The area of ventilation openings shall comply with Table 703.5.1 ~~**703.5.1.1**~~. Where *hurricane shelters* are also designed as *tornado shelters*, openings provided to relieve internal pressure for atmospheric pressure change (APC) per Section 304.7 shall be permitted to be counted as *natural ventilation* openings.

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Manley Vote:		x		

Your comment/reason: In bringing proposed Section 703.1 (Hurricane Shelter Ventilation) into the Clean Draft as Section 703.5, the references in the paragraph were not updated correctly. Additionally, I think it would be better to swap the first sentence "Occupied space…" with the second sentence "All hurricane shelters…" This would parallel what is done for Tornado Shelter Ventilation (See Clean Draft Section 702.3).

Revise as follows:

702.3 Ventilation. Occupied space in *tornado shelters* shall be provided with *natural ventilation* in accordance with Section 702.3.1 or with mechanical ventilation in accordance with Section 702.3.2. Openings used for atmospheric pressure change (APC) are permitted to be counted as ventilation for the purposes of this section. Ventilation openings for natural and mechanical ventilation shall comply with Section 702.3.3 and 702.3.4.

703.5 Ventilation. Occupied spaces in all *hurricane shelters* shall be provided with *natural ventilation* in accordance with Section 703.5.1. Occupied space in *community hurricane shelters* with a *storm shelter design occupant capacity* of 50 or greater shall be ventilated by mechanical means in accordance with Section ~~703.1.2~~ 703.5.2. ~~All *hurricane shelters* shall be provided with *natural ventilation* in accordance with Section 703.1.1.~~ Ventilation openings for natural and mechanical ventilation shall comply with

Section ~~703.1.3 and 703.1.4~~ 703.5.3 and 703.5.4.

703.5.1 ~~703.5.1.1~~ *Natural ventilation*. All *hurricane shelters* shall be provided with openings to facilitate minimum *natural ventilation* in accordance with this section. The area of ventilation openings shall comply with Table 703.5.1 ~~**703.5.1.1**~~. Where *hurricane shelters* are also designed as *tornado shelters*, openings provided to relieve internal pressure for atmospheric pressure change (APC) per Section 304.7 shall be permitted to be counted as *natural ventilation* openings.

Staff note: The code section references will be fixed as errata.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Schultz Vote:		**x**		

Your comment/reason: *Sections 703.5.1.1 and 703.5.2-The requirement for ventilation between natural and mechanical ventilation is not consistent. Mechanical ventilation requires outside air be provided however natural ventilation does not contain the term "outside" which allows "fresh" air to be supplied from adjacent spaces. The requirement for where the fresh air is coming from should be consistent between the two options. Per the IMC and ASHRAE, ventilation requires outside air which is inconsistent with the natural ventilation provision.*

No revisions suggested:

702.3.1 *Natural ventilation*. *Tornado shelters* that rely on *natural ventilation* shall be provided with the minimum ventilation area in accordance with Table 702.3.1.

702.3.2 Mechanical ventilation. *Tornado shelters* that rely on mechanical ventilation shall be provided with the minimum mechanical ventilation rate of required outdoor air at a minimum rate of 5 cubic feet per minute per occupant for the *storm shelter occupant load*. The mechanical ventilation system shall be connected to a standby power system.

703.5.1 ~~703.5.1.1~~ *Natural ventilation*. All *hurricane shelters* shall be provided with openings to facilitate minimum *natural ventilation* in accordance with this section. The area of ventilation openings shall comply with Table 703.5.1 ~~**703.5.1.1**~~. Where *hurricane shelters* are also designed as *tornado shelters*, openings provided to relieve internal pressure for atmospheric pressure change (APC) per Section 304.7 shall be permitted to be counted as *natural ventilation* openings.

703.5.2 Mechanical ventilation. The minimum mechanical ventilation rate of required outdoor air shall be determined at a minimum rate of 5 cubic feet per minute per occupant for the *storm shelter occupant load*. The mechanical ventilation system shall be connected to a standby power system.

Staff note: The red section references are errata.
Staff question: If the duct to the outside is not within the shelter, how do you maintain the outside air requirement?

IS-STM 07-08-18

ICC 500 Section 702.2, Table 702.2, 702.2.1, 702.2.2, 702.2.3, 703.2, Table 703.2, 703.2.1, 703.2.2, 703.2.3

Proponent: Marc Levitan, representing ICC 500 Committee

Revise as follows:

SECTION 702
TORNADO SHELTERS

702.2 Sanitation ~~facilities~~ stations. ~~Toilet and hand-washing facilities shall be located within the tornado shelter area and provided in the minimum number shown in Table 702.2.~~ Each tornado shelter area shall be provided with toilets and hand-washing stations in accordance with Table 702.2. The required toilets and hand-washing stations shall be located within the shelter area.

TABLE 702.2
REQUIRED SANITATION ~~FACILITIES~~ STATIONS, TORNADO SHELTERS

STORM SHELTER TYPE	TOILET ~~FACILITIES~~ STATIONS	HAND-WASHING ~~FACILITIES~~ STATIONS
Residential, one- and two-family dwellings	Not Required	Not Required
Residential, other	1	Not Required
Community (≤50 occupants)	1	Not Required
Community (> 50 occupants)	2 minimum for the first 500 occupants and 1 additional per 500 occupants or portions thereof > 500 occupants	1 per 1000 occupants

702.2.1 Required toilets and hand-washing ~~facilities~~ stations. Sanitation ~~facilities~~ stations provided for the normal occupancy installed within the shelter shall be included in the overall shelter sanitation facility count.

702.2.2 Additional ~~facilities~~ sanitation stations for storm shelters. Where the required number of sanitation ~~facilities~~ stations for the tornado shelter exceeds the number of facilities provided for the normal occupancy of the space, the additional ~~facilities~~ stations shall be permitted to be temporary sanitary fixtures, chemical toilets or other means approved by the authority having jurisdiction.

702.2.3 Sanitation ~~facilities~~ support systems. Support systems for the sanitation facilities and stations (e.g., bladders, storage tanks or vessels, etc.) shall be capable of supplying water and containing waste for the design capacity of the tornado shelter.

702.2.4 Conversion of plumbing systems. Plumbing and valve systems of fixtures located within the tornado shelter shall be permitted to be designed for conversion to emergency operation to meet the required demand.

SECTION 703
HURRICANE SHELTERS

703.2 Sanitation ~~facilities~~ stations. ~~Toilet and hand-washing facilities shall be located within the storm shelter area and provided in the minimum number shown in Table 703.2~~. Each hurricane shelter area shall be provided with toilets and hand-washing stations in accordance with Table 703.2. The required toilets and hand-washing stations shall be located within the shelter area.

TABLE 703.2
REQUIRED SANITATION ~~FACILITIES~~ STATIONS FOR HURRICANE SHELTERS

HURRICANE SHELTER TYPE	TOILET ~~FACILITIES~~ STATIONS	HAND-WASHING ~~FACILITIES~~ STATIONS
Residential, one-and two-family dwellings	Not Required	Not Required
Residential, other	1	Not Required
Community shelters (≤50 occupants)	1	Not Required
Community shelters (> 50 occupants)	1 per 50 occupants	1 per 100 occupants

703.2.1 Required toilets and hand-washing facilities. Sanitation facilities provided for the normal occupancy installed within the shelter shall be included in the overall shelter sanitation ~~facility~~ station count.

703.2.2 Additional ~~facilities~~ sanitation stations for storm shelters. Where the required sanitation ~~facilities~~ stations for the hurricane shelter exceed the required number of facilities provided for the normal occupancy of the space, the additional ~~facilities~~ stations shall be permitted to be temporary sanitary fixtures, chemical toilets or other means that are deemed acceptable by the authority having jurisdiction.

703.2.3 Sanitation ~~facilities~~ support systems. Support systems for the sanitation facilities and stations (e.g., bladders, storage tanks or vessels, etc.) shall be capable of supplying water and containing waste for the design capacity of the storm shelter.

703.3 Water supply and storage. The capacity of plumbing and waste disposal systems to supply potable water and contain or dispose of waste water or solid wastes shall be determined in accordance with Table 703.3.

TABLE 703.3
WATER SUPPLY AND WASTE WATER STORAGE
HURRICANE SHELTERS

STORM SHELTER TYPE	POTABLE WATER	WASTE WATER
Residential, one- and two-family dwellings	Not Required	Not Required
Residential, other	Not Required	Not Required
Community (≤50 occupants)	Not Required	Not Required
Community (> 50 occupants)	1 gallon per occupant	1.5 gallons per occupant

For SI: 1 gallon = 3.785 L.

Reason: Issues:

- The IPC definition for toilet facility is "a room or space that contains not less than one water closet and one lavatory." Use of the phrase "toilet facility" could lead to confusion as to what is required by the standard. Although the IPC (and other model plumbing codes) use the term "water closet" to mean what plumbing fixture manufacturers call a "toilet", the term "toilet" seems more appropriate for the standard rather than "toilet facility".
- The phrase "hand washing *facility*" is could be interpreted as requiring *water-supplied* lavatories or sinks for washing hands. But perhaps that is not the intent as Section 702.2.2 allows for chemical toilets to satisfy "toilet" requirements of the shelter…therefore, where wouldn't hand washing by other means (nonwater type) be satisfactory for the time window.

Committee Action: As Submitted (8-0)

Committee Reason: This improves consistency between codes for terminology. This will reduce confusion about when permanent toilets and lavatories are being required vs. chemical fixtures.

IS-STM 07-08-18

IS-STM 07-08-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	1
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason

Ehrlich Vote:		**x**		

Your comment/reason: The word "area" is not necessary in referring to the tornado or hurricane shelter and could be misleading. For example, a tornado shelter incorporating a school's multi-purpose room, kitchen serving the multipurpose room, and an office within the shelter envelope could be interpreted as having three "areas", each needing their own separate toilet facility.

Revise as follows:

702.2 Sanitation stations. Each *tornado shelter* ~~area~~ shall be provided with toilets and hand-washing stations in accordance with Table 702.2. The required toilets and hand-washing stations shall be located within the *tornado shelter* ~~area~~.

703.2 Sanitation stations. Each *hurricane shelter* ~~area~~ shall be provided with toilets and hand-washing stations in accordance with Table 703.2. The required toilets and hand-washing stations shall be located within the *hurricane shelter* ~~area~~.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason:
The introduction of the words "Sanitation facilities" or "Sanitation stations" makes it even more confusing. The IPC says "Minimum Plumbing Facilities" and "Minimum number of fixtures" then uses water closets and lavatories in the table, and we should use the same terms. Delete the word "area" because it makes it sound like they are required in each area.

Revise as follows:

~~**702.2 Sanitation facilities stations.** Toilet and hand-washing facilities shall be located within the tornado shelter area and provided in the minimum number shown in Table 702.2. Each *tornado shelter* area shall be provided with toilets and hand-washing stations in accordance with Table 702.2. The required toilets and hand-washing stations shall be located within the *tornado shelter* area.~~

702.2 Minimum number of fixtures. Water closets and lavatories shall be located within the tornado shelter and provided in the minimum number as shown in Table 702.2.

702.2.1 Required toilets and hand-washing fixtures ~~stations~~. ~~Sanitation stations~~ Fixtures provided for the normal occupancy installed within the *tornado shelter* shall be included in the overall *tornado shelter* ~~sanitation facility~~ fixture count.

702.2.2 Additional fixtures ~~stations~~ for *tornado* ***shelters*****.** Where the required number of fixtures ~~sanitation stations~~ for the *tornado shelter* exceeds the number of fixtures ~~stations~~ provided for the normal occupancy of the space, the additional fixtures ~~facilities~~ shall be permitted to be temporary ~~sanitary stations~~ fixtures, such as chemical toilets or other means approved by the *authority having jurisdiction*.

702.2.5 Toilet fixture ~~station~~ privacy. Each toilet fixture ~~station~~ shall occupy a separate compartment with walls, partitions, curtains or equivalent that enclose the fixtures to ensure privacy.

IS-STM 07-09-18
ICC 500 Table 702.2, Table 703.2

Proponent: Corey Shultz, Schultz Squared Architects LLC

Revise as follows:

SECTION 702
TORNADO SHELTERS

702.2 Sanitation facilities. Toilet and hand-washing facilities shall be located within the tornado shelter area and provided in the minimum number shown in Table 702.2.

TABLE 702.2 REQUIRED SANITATION FACILITIES, TORNADO SHELTERS

STORM SHELTER TYPE	TOILET FACILITIES a, b, c	HAND- WASHING FACILITIES
Residential, one- and two-family dwellings	Not Required	Not Required
Residential, other	1	Not Required
Community (≤ 50 occupants)	1	Not Required
Community (> 50 occupants)	~~2 minimum~~ 1 per 250 for the first 500 occupants and 1 additional per 500 occupants or portions thereof >500 occupants d	1 per 1000 occupants

a. Toilet facilities shall be permanently mounted water closets, temporary chemical toilets, or other equivalent capability approved by the authority having jurisdiction.
b. Toilets can be substituted with urinals but shall not reduce the number of required men's toilets by more than 50%. Reference note d.
c. For community shelters, each sex shall have access to a minimum of one toilet facility and hand-washing facility provided in accordance with ICC A117.1.
d. Toilet facilities shall be provided for each sex and equal number of toilet facilities shall be provided for both sexes. All required toilet facilities or portions thereof may be provided as single-user facilities.

SECTION 703
HURRICANE SHELTERS

703.2 Sanitation facilities. Toilet and hand-washing facilities shall be located within the storm shelter area and provided in the minimum number shown in Table 703.2.

TABLE 703.2 REQUIRED SANITATION FACILITIES FOR HURRICANE SHELTERS

	TOILET	HAND-WASHING

HURRICANE SHELTER TYPE	FACILITES [a, b, c]	FACILITIES
Residential, one-and two-family dwellings	Not Required	Not Required
Residential, other	1	Not Required
Community shelters (≤ 50 occupants)	1	Not Required
Community shelters (> 50 occupants)	1 per 50 occupants [d]	1 per 100 occupants

a. Toilet facilities shall be permanently mounted water closets, temporary chemical toilets, or other equivalent capability approved by the authority having jurisdiction.
b. Toilets can be substituted with urinals but shall not reduce the number of required men's toilets by more than 50%. Reference note d.
c. For community shelters, each sex shall have access to a minimum of one toilet facility and hand-washing facility provided in accordance with ICC A117.1.
d. Toilet facilities shall be provided for each sex and equal number of toilet facilities shall be provided for both sexes. All required toilet facilities or portions thereof may be provided as single-user facilities.

Reason for 702.2:
For Community shelter >50, As written, two toilets for a shelter for 51 occupants is disproportionate to the total area required for the shelter occupants especially in jurisdictions where if toilets are provided, they must meet ADA requirements. Net area for 51 occupants would be 255 sf. For two ADA toilets, this would require approximately 100 gross sf, an additional 40% of the area required for shelter. The proposed revision would keep the additional area for the required facilities more reasonable for shelters between 50 and 125 occupants.

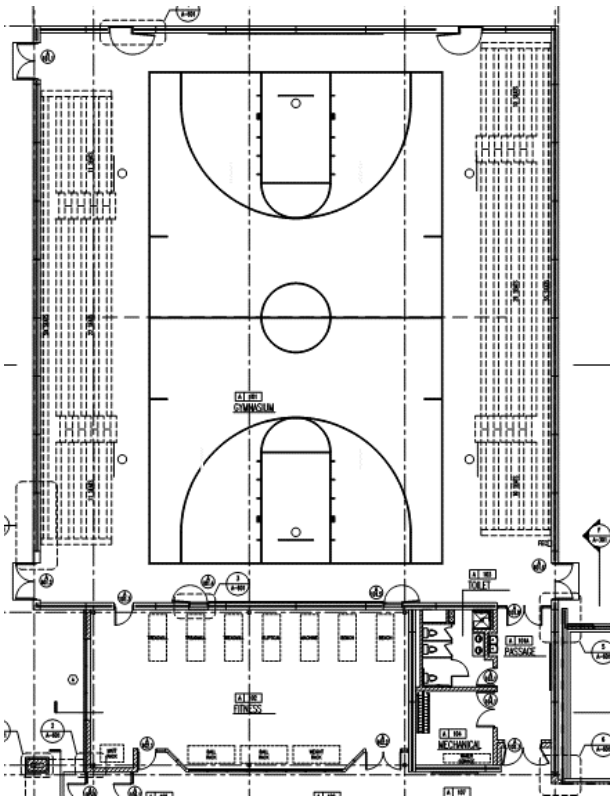
Note a-The term toilet facilities is defined in the IPC as "a room or space that contains at least one water closet and one lavatory" with a table prescribing the number/types of fixtures required. The same code term is being used here but with a different intent. As used in this code standard, the term "toilet facilities" does not indicate the type of fixture i.e. urinals or water closets. The intent of the note is to clarify the intent of the code standard.

Note b-If more than one toilet is provided for men, urinals may be substituted but cannot reduce the required number by more than 50% again clarifying the intent of the term "toilet facilities".

Note c-ICC 500 section 501.6 requires shelters to be on an accessible route for handicap individuals. If the shelter is handicap accessible, it should be stated that a toilet and hand-washing facility shall meet the requirements of ICC A117.1 which is a referenced documents in this standard.

Note d-There are many toilet facility configurations being designed for storm shelters. Below is a recent facility associated with a community shelter in a school for 550 occupants. As the standard is written, this would require three toilet facilities and one hand-washing facility. As you can see in this case, the number of the required facilities has been provided however, they have been installed in a single room. One could argue that this configuration does not meet the IBC 2902.2 and IPC 403.2 requiring separate facilities however since the term toilet facilities differ between the IBC/IPC and the code standard, one could argue that it would these sections would not apply to the code standard. This note also clarifies the condition where there is an odd number of toilets required. On numerous occasions during peer reviews where a shelter had an odd number of toilet fixtures required, equal number would be given to men and women with the odd fixture being added as a urinal in the men's toilet. This note would allow all

required fixtures to be located in unisex toilet rooms, or equal fixtures for men and women with an odd number to be unisex.



Suggested revisions to commentary:

Due to the short design duration of occupancy for tornado shelters, the quantity of toilet and hand-washing fixtures required within the occupied shelter area can be reduced in comparison with that of the host building and its respective occupancy classifications(s). Sanitation facilities must be provided for the shelter type and in the minimum number shown in Table 702.2. In situations where there are multiple separated and independent occupied shelter areas, each separate occupied shelter area must be provided with sanitation facilities for the storm shelter type and in the minimum number shown in Table 702.2. ~~The required sanitation facilities provided inside the occupied shelter area may be either permanent or temporary fixtures, or other equivalent capability approved by the authority having jurisdiction.~~

Commentary-Deleted text has been included in table note a.

Reason for 703.2:

Note a-The term toilet facilities is defined in the IPC as "a room or space that contains at least one water closet and one lavatory" with a table prescribing the number/types of fixtures required. The same code term is being used here but with a different intent. As used in this code standard, the term "toilet facilities" does not indicate the type of fixture i.e. urinals or water closets. The intent of the note is to clarify the intent of the code standard.

Note b-If more than one toilet is provided for men, urinals may be substituted but cannot reduce the required number by more than 50% again clarifying the intent of the term "toilet facilities".

Note c-ICC 500 section 501.6 requires shelters to be on an accessible route for handicap individuals. If the shelter is handicap accessible, it should be stated that a toilet and hand-washing facility shall meet the requirements of ICC A117.1 which is a referenced documents in this standard.

Note d-This note requires equal distribution of the required toilet facilities and also clarifies the condition where there is an odd number of toilets required. This note will allow all required fixtures to be located in unisex toilet rooms, or equal fixtures for men and women with an odd number to be a unisex facility.

Staff note: This proposal was submitted as two proposals.
Requirements should not be in footnotes. Suggest moving to a section.
702.2 –
Toilet rooms are often used as tornado shelters.

- Footnote a is already addressed in ICC 500 Section 702.2.1 and 702.2.2
- Footnote b will conflict with IPC Section 424.2 for Group E and A.
- If the toilet facilities are permanent, they will already be required to be accessible by the IBC and IPC. A temporary chemical toilet could probably not be made accessible in accordance with ICC A117.1.
- Single occupant bathrooms are required to be gender neutral by the IPC. Single-occupant toilet rooms can count towards the required fixture count (IPC 403.1.2).
- You cannot use "may" in code text.

703.2 –
Toilet rooms are often used as tornado shelters.

- Footnote a is already addressed in ICC 500 Section 703.2.1 and 703.2.2
- Footnote b will conflict with IPC Section 424.2 for Group E and A.
- If the toilet facilities are permanent, they will already be required to be accessible by the IBC and IPC. A temporary chemical toilet could probably not be made accessible in accordance with ICC A117.1.
- Single occupant bathrooms are required to be gender neutral by the IPC. Single-occupant toilet rooms can count towards the required fixture count (IPC 403.1.2).
- You cannot use "may" in code text.

2018 IPC
424.2 Substitution for water closets. In each bathroom or toilet room, urinals shall not be substituted for more than 67 percent of the required water closets in assembly and educational *occupancies*. Urinals shall not be substituted for more than 50 percent of the required water closets in all other *occupancies*.

403.1.2 Single-user toilet facility and bathing room fixtures. The plumbing fixtures located in single-user toilet facilities and bathing rooms, including family or assisted use toilet and bathing rooms that are required by Section 1109.2.1 of the *International Building Code*, shall contribute toward the total number of required plumbing fixtures for a building or tenant space. Single-user toilet facilities and bathing rooms, and family or assisted-use toilet rooms and bathing rooms shall be identified for use by either sex.

403.2 Separate facilities. Where plumbing fixtures are required, separate facilities shall be provided for each sex.
Exceptions:

1. Separate facilities shall not be required for dwelling units and sleeping units.
2. Separate facilities shall not be required in structures or tenant spaces with a total occupant load, including both employees and customers, of 15 or fewer.
3. Separate facilities shall not be required in mercantile *occupancies* in which the maximum occupant load is 100 or fewer.
4. Separate facilities shall not be required in business occupancies in which the maximum occupant load is 25 or fewer.

Committee Action: As Modified (8-0)

Replace with the following:

702.2 Sanitation facilities. Toilet and hand-washing facilities shall be located within the tornado shelter area and provided in the minimum number shown in Table 702.2.

TABLE 702.2 REQUIRED SANITATION FACILITIES, TORNADO SHELTERS

STORM SHELTER TYPE	TOILET FACILITIES	HAND- WASHING FACILITIES
Residential, one- and two-family dwellings	Not Required	Not Required
Residential, other	1	Not Required
Community (≤ 50 occupants)	1	Not Required
Community (> 50 occupants)	~~2 minimum~~ 1 per 250 for the first 500 occupants and 1 additional per 500 occupants or portions thereof >500 occupants	1 per 1000 occupants

702.2.1 Required toilets and hand-washing facilities. Sanitation facilities provided for the normal occupancy installed within the shelter shall be included in the overall shelter sanitation facility count.

702.2.2 Additional facilities for storm shelters. Where the required number of sanitation facilities for the tornado shelter exceeds the number of facilities provided for the normal occupancy of the space, the additional facilities shall be permitted to be temporary sanitary fixtures, chemical toilets or other means approved by the authority having jurisdiction.

702.2.3 Urinals. Urinals shall be permitted to be substituted for water closets in accordance with the International Plumbing Code Section 424.

702.2.4 Fixture calculations. The number of fixtures for each sex shall be allocated in accordance with the International Plumbing Code Section 403.1.1.

~~**702.2.3**~~ **702.2.5 Sanitation facilities support systems.** Support systems for the sanitation facilities (e.g., bladders, storage tanks or vessels, etc.) shall be capable of supplying water and containing waste for the design capacity of the tornado shelter.

~~**702.2.4**~~ **702.2.6 Conversion of plumbing systems.** Plumbing and valve systems of fixtures located within the tornado shelter shall be permitted to be designed for conversion to emergency operation to meet the required demand.

703.2 Sanitation facilities. Toilet and hand-washing facilities shall be located within the storm shelter area and provided in the minimum number shown in Table 703.2.

TABLE 703.2 REQUIRED SANITATION FACILITIES FOR HURRICANE SHELTERS

HURRICANE SHELTER TYPE	TOILET FACILITES	HAND-WASHING FACILITIES
Residential, one-and two-family dwellings	Not Required	Not Required
Residential, other	1	Not Required
Community shelters (≤ 50 occupants)	1	Not Required
Community shelters (> 50 occupants)	1 per 50 occupants	1 per 100 occupants

703.2.1 Required toilets and hand-washing facilities. Sanitation facilities provided for the normal occupancy installed within the shelter shall be included in the overall shelter sanitation facility count.

703.2.2 Additional facilities for storm shelters. Where the required sanitation facilities for the hurricane shelter exceed the required number of facilities provided for the normal occupancy of the space, the additional facilities shall be permitted to be temporary sanitary fixtures, chemical toilets or other means that are deemed acceptable by the authority having jurisdiction.

703.2.3 Urinals. Urinals shall be permitted to be substituted for water closets in accordance with the International Plumbing Code Section 424.

703.2.4 Fixture calculations. The number of fixtures for each sex shall be allocated in accordance with the International Plumbing Code Section 403.1.1.

~~**703.2.3**~~ **703.2.5 Sanitation facilities support systems.** Support systems for the sanitation facilities (e.g., bladders, storage tanks or vessels, etc.) shall be capable of supplying water and containing waste for the design capacity of the storm shelter.

Committee Reason: Modification was to eliminate conflicts with IPC. Clarification of types of fixtures permitted.

IS-STM 07-09-18

IS-STM 07-09-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	0
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Erhlich Vote:		x		

Your comment/reason: Per IPC Section 403.2, there are cases where separate facilities for each sex are not required. IPC Section 403.1.2 also permits single-use facilities. To avoid confusion, suggest deleting the phrase “for each sex”.

Revise as follows:

702.2.4 Fixture calculations. The number of fixtures ~~for each sex~~ shall be allocated in accordance with the International Plumbing Code Section 403.1.1.

703.2.4 Fixture calculations. The number of fixtures ~~for each sex~~ shall be allocated in accordance with the International Plumbing Code Section 403.1.1.

IS-STM 07-11-18
ICC 500 Section 702.2.5(New) and Table 702.2.5(New)

Proponent: Benchmark Harris, The National Storm Shelter Association (NSSA) Design Practices Committee

Revise as follows:

702.2.5 Water supply and storage. The capacity of plumbing and waste disposal systems to supply potable water and contain or dispose of waste water or solid wastes shall be determined in accordance with Table 702.2.5.

Table 702.2.5 WATER SUPPLY AND WASTE WATER STORAGE

TORNADO SHELTERS		
STORM SHELTER TYPE	**POTABLE WATER**	**WASTE WATER**
Residential, one- and two- family dwellings	Not Required	Not Required
Residential, other	Not Required	Not Required
Community (<= 50 occupants)	Not Required	Not Required
Community (> 50 occupants)	1/12 gallon per occupant	1/8 gallon per occupant

Reason:

Section 702.2.3 requiring that storage tanks for sanitation facilities in tornado shelters be capable of supplying water and containing waste for the design capacity of the shelter is similar to the language for hurricane shelters in Section 703.2.3. However there is no language in Section 702 for tornado shelters that's comparable to Section 703.3 for hurricane shelters, which introduces Table 703.3 and there's no comparable table in Section 702 for Tornado shelters. Without the comparable language and table in the tornado shelter provisions, it is unclear whether or not the intent is merely that storage vessels for sanitation facilities are required to be sized for the design capacity if and only if they are used, or if it is a requirement that such storage vessels be provided. It is also unclear how to size these containers for the 2 hour tornado shelter occupancy because there is no referenced standard for the water and wastewater demand during such an event. The addition of the proposed new Section 702.2.5 and Table 702.2.5 provides criteria that are equivalent to 1/12 of the required volumes for hurricanes. 1/12 is logical because this is the ratio of the occupancy durations for tornado shelters (2 hours) divided by the occupancy durations for hurricane shelters (24 hours).

Committee Action: Disapproval (8-0)

Committee Reason: Not justified for tornado shelters. Not time to move resources into a tornado shelter – such as bottled water. Adding tanks for supply and waste water storage in the shelter does add a lot to the cost.

IS-STM 07-11-18

IS-STM 07-11-18		Committee action: Disapproval			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	1
Staff Notes:					

		Committee action: Disapproval		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Dain PC:		x		

Your comment/reason: The committee determined water and waste storage was not required in our reason statement in 07-11-18, but we missed following up with deleting this 702.2.3 section for tornado shelters.

Revise as follows:

~~**702.2.6 Sanitation support systems.** Support systems for the sanitation facilities and stations (e.g., bladders, storage tanks or vessels, etc.) shall be capable of supplying water and containing waste for the design capacity of the *tornado shelter.*~~

		Committee action: Disapproval		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Harris PC:			x	

Your comment/reason: IS-STM 07-11-18 proposed a methodology for determining how much volume of water and wastewater should be stored per person for a tornado shelter, following the tabular methodology provided in previous versions of ICC 500 for hurricane shelters. The only reason a methodology was proposed is because the above section indicates that any storage tanks that support sanitation facilities are required to be designed for the design capacity of the tornado shelter. There is not an existing methodology in the industry defining how much volume is required per person for cases like this and the closest thing is the ICC 500 methodology for hurricane shelters. However, IS-STM 07-11-18 was disapproved and the committee's reason was:

> "Not justified for tornado shelters. Not time to move resources into a tornado shelter – such as bottled water. Adding tanks for supply and waste water storage in the shelter does add a lot to the cost."

By the committee's reason statement, the committee has indicated that the intent of the code is to not require any storage of water or wastewater in tornado shelters. If so, Section 702.2.6 should be removed. If this section is removed, that action would address the original concern that IS-STM 07-11-18 was trying to address because there would no longer be any need to define a methodology for defining the minimum required volumes per person.

Revise as follows:

~~**702.2.6 Sanitation support systems.** Support systems for the sanitation facilities and stations (e.g., bladders, storage tanks or vessels, etc.) shall be capable of supplying water and containing waste for the design capacity of the *tornado shelter*.~~

IS-STM 07-12-18
ICC 500 Section 702.4, 703.7

Proponent: Andrew Herseth, Pataya Scott and Glenn Overcash, Federal Emergency Management Agency and AECOM representing FEMA

Revise as follows:

SECTION 702
TORNADO SHELTERS

702.4 First aid kit. A first aid kit rated for the number of storm shelter occupants, as listed in the construction documents, shall be supplied in all tornado shelters ~~with a shelter occupant load of greater than 50~~.

SECTION 703
HURRICANE SHELTERS

703.7 First aid kit. A first aid kit rated for the number of storm shelter occupants, as listed in the construction documents, shall be supplied in all ~~community~~ hurricane shelters.

Reason: Potential storm shelter occupants are frequently injured by accidents in their rush to get to the tornado storm shelter. The risk to occupants is not a function of the storm shelter size and therefore the requirement for first aid kits should apply regardless of shelter occupant load. Having a first aid kit rated for the number of occupants would be the best preparation for treating occupants' potential injuries.

Hurricanes are long duration events and occupants are unable to leave the shelter for treatment of injuries that may occur while sheltering. Having a first aid kit rated for the number of occupants would be the best preparation for treating the potential injuries of shelter occupants. The risk of injury while sheltering for 24 hours or longer is not limited to occupants of community shelters and therefore should be extended to all hurricane shelters.

Staff note: This proposal was submitted as two proposals.

Committee Action: As Modified (7-0 meeting)(11-0 electronic vote)

Replace with the following;

SECTION 702
TORNADO SHELTERS

702.4 First aid kit. A first aid kit shall be supplied in all community tornado shelters ~~with a shelter occupant load of greater than 50~~ that complies with ANSI/ISEAI Z308.1, Class A First Aid Kit.

SECTION 703
HURRICANE SHELTERS

703.7 First aid kit. A first aid kit shall be supplied in all community hurricane shelters that complies with ANSI/ISEAI Z308.1, Class A First Aid Kit.

Exception: A first aid kit is not required where equivalent first aid supplies are located in the building.

Chapter 9
International Safety Equipment Association (ISEA)
ANSI/ISEA Z308.1-2015 Minimum Requirements for Workplace First Aid Kits and Supplies

Committee Reason: The standard will clarify what is required for the first aid kits. Since the time frame is much quicker for tornadoes, there is not an exception for supplies in the building. Commentary should indicate where a higher level or additional supplies should be provided. Also should be added as a consideration in the operational appendix.

IS-STM 07-12-18

IS-STM 07-12-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	0
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		

Your comment/reason: Editorial cleanup and simplification of the language.

Revise as follows:

702.8 First aid kit. A Class A first aid kit complying with ANSI/ISEAI Z308.1 shall be supplied in all *community tornado shelters* ~~that complies with ANSI/ISEAI Z308.1, Class A First Aid Kit~~.

703.10 First aid kit. A Class A first aid kit complying with ANSI/ISEAI Z308.1 shall be supplied in all *community hurricane shelters* ~~that complies with ANSI/ISEAI Z308.1, Class A First Aid Kit~~.

IS-STM 07-13-18

ICC 500 Section 202, 702.1.2, 702.3, 702.3.1, 702.3.2, 702.4(New), 703.1.1, 703.4, 703.5, 703.6, 703.6.1, 703.6.2, 703.6.3, 703.6.4, 703.6.5

Proponent: Crystal Wespestad, representing self

Revise as follows:

SECTION 202 DEFINITIONS

CRITICAL SUPPORT SYSTEMS. Structures, systems and components required to ensure the health, safety and well-being of occupants. Critical support systems include, but are not limited to, potable and waste water systems, electrical power systems, life safety systems and HVAC systems.

OCCUPANT SUPPORT AREAS. The areas required to ensure the health, safety and well-being of occupants. Occupant support areas <u>are areas</u> <u>that serve the shelter and</u> include, but are not limited to, shelter management, food preparation, water and food storage, electrical and mechanical rooms, toilet and other sanitation rooms and first-aid stations.

OCCUPIED SHELTER AREAS. The designated storm shelter area.

SECTION 702
TORNADO SHELTERS

702.1.2 Mechanical ventilation. Tornado shelters that rely on mechanical ventilation shall be provided with the minimum mechanical ventilation rate of required outdoor air in accordance with the applicable building code provisions for the normal use of the space. The mechanical ventilation system shall be connected to an ~~emergency~~ <u>standby</u> power system.

702.3 ~~Emergency~~ <u>Standby</u> lighting. Community tornado shelters shall be provided with an ~~emergency~~ <u>standby</u> lighting system. The ~~emergency~~ <u>standby</u> lighting system shall provide ~~an average~~ <u>illumination levels</u> of <u>not less than</u> 1 foot-candle (11 lux) ~~of illumination~~ <u>at the walking surface</u> in occupied shelter areas~~,~~ <u>and</u> occupant support areas~~, required corridors, passageways and means of egress~~.

> **<u>Exception:</u>** <u>Personal-use flashlights shall be permitted for the standby lighting system requirement for tornado shelters with an occupant load of less than or equal to 50, when provided at a quantity not less than one (1) flashlight per 10 occupants. Personal-use flashlights shall be a minimum of two “D” cell size or equivalent light output, and readily accessible from within the occupied shelter areas or immediately adjacent occupant support areas.</u>

702.4 Standby power. Community tornado shelters shall be provided with a standby power system. The standby power system shall support occupied tornado shelter areas, and occupant support areas.

702.4.1 ~~702.3.1~~ Capacity. The ~~emergency electrical~~ standby power system shall have adequate capacity and rating to supply all required systems and circuits for standby lighting and any mechanical ventilation systems intended to be operated at one time.

702.4.2 ~~702.3.2~~ Duration. The ~~emergency electrical~~ standby power system shall be designed to provide continuously the required output capacity for a minimum of 2 hours.

~~**Exception:** Personal-use flashlights shall be permitted for the emergency standby lighting system requirement for tornado shelters with an occupant load of less than or equal to 50, when provided at a quantity not less than one (1) flashlight per 10 occupants. Personal-use flashlights shall be a minimum of two "D" cell size or equivalent light output, and readily accessible from within the occupied shelter areas or immediately adjacent occupant support areas.~~

SECTION 703
HURRICANE SHELTERS

703.1 Ventilation. Every occupied space in community hurricane shelters with an occupant load greater than 50 shall be ventilated by mechanical means in accordance with Section 703.1.1. All hurricane shelters shall be provided with natural ventilation in accordance with Section 703.1.2.

703.1.1 Mechanical ventilation. The minimum mechanical ventilation rate of required outdoor air shall be determined in accordance with the applicable building code provisions for the normal use of the space. The mechanical ventilation system shall be connected to an standby power system.

703.1.2 Natural ventilation. All shelters shall be provided with openings to facilitate minimum natural ventilation in accordance with this section. The area of ventilation openings shall comply with Table 703.1 and the location of openings shall be in accordance with Section 703. Where hurricane shelters are also designed as tornado shelters, openings provided to relieve internal pressure for atmospheric pressure change (APC) per Section 304.7 shall be permitted to be counted as natural ventilation openings.

703.4 ~~Emergency~~ Standby lighting. Community hurricane shelters shall be provided with an ~~emergency~~ standby lighting system. The ~~emergency~~ standby lighting system shall provide ~~an average~~ illumination levels of not less than 1 foot-candle ~~of illumination~~ (11 lux) at the walking surface in occupied shelter areas, and occupant support areas, ~~required corridors, passageways and means of egress~~.

Exception: Personal-use flashlights shall be permitted for the ~~emergency~~ standby lighting system requirement for hurricane shelters with an occupant load less than or equal to 50, when provided at a quantity not less than one (1) flashlight per 10 occupants. Personal-use flashlights shall be a minimum of two "D" cell size or equivalent light output, and readily accessible from within the occupied shelter areas or immediately adjacent occupant support areas.

~~**703.5 Standby lighting.** Community hurricane shelters with a shelter occupant load greater than 50 shall be provided with a standby lighting system. The standby lighting system shall provide an average of 10 footcandles illumination (110 lux) in occupied shelter areas, occupant support areas, required corridors, passageways and means of egress.~~

703.6 Standby power. Community hurricane shelters with a shelter occupant load greater than 50 shall be provided with a standby ~~electrical~~ power system. The standby ~~electrical~~ power system shall support occupied hurricane shelter areas~~,~~ and occupant support areas ~~and critical support systems~~. ~~At a minimum, the standby electrical power system shall supply power to life safety systems and critical branch lighting circuits. Where required by the authority having jurisdiction, the standby electrical power system shall also supply power to selected HVAC circuits.~~

703.6.1 Capacity. The standby ~~electrical~~ power system shall have adequate capacity and rating to supply all required systems and circuits for standby lighting and any mechanical ventilation systems intended to be operated at one time.

703.6.2 Duration. The standby ~~electrical~~ power system shall be designed to provide continuously the required output capacity for a minimum of 24 hours.

703.6.3 Independence. The standby ~~electrical~~ power supply shall be located on-site, and shall be independent of off-site sources of fuel or water.

703.6.4 Protection of components. Standby ~~electrical~~ power supply, transformers, distribution panels, cabling, fuel supply storage tanks, fuel lines and other critical system components shall be protected from design event conditions.

703.6.5 Location. Standby ~~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 in accordance with this standard.

Reason: The purpose of this proposal is to clarify power and lighting requirements for shelters and to have consistency in the language for tornado and hurricane shelters.

There seems to be great confusion in the lighting terminology. There are requirements in the IBC for general means of egress lighting when the building is occupied (IBC Section 1008.2) and for emergency lighting (IBC Section 1008.3). Means of egress lighting is general lighting when a space is occupied (i.e. not just corridors). Emergency lighting is for space with two exits, and then only along aisles, corridors, stairways and ramps. The lighting level is permitted to be lower than the general lighting. Is the intent of the ICC 500 lighting to consider these spaces occupied and require general means of egress lighting level when they are in use? Battery emergency lights are only required to run for 90 minutes – that does not match duration time.

There is also a difference between standby power and emergency power. Emergency lighting is on emergency power for immediate evacuation upon loss of building power and life safety systems. Standby power is for systems to continue to operate after a building has lost power. See IBC Chapter 27 to see which systems are emergency vs. standby power.

> **[F] 2702.1.3 Installation.** Emergency power systems and standby power systems required by this code or the *International Fire Code* shall be installed in accordance with the *International Fire Code*, NFPA 70, NFPA 110 and NFPA 111.
> **[F] 2702.1.4 Load transfer.** Emergency power systems shall automatically provide secondary power within 10 seconds after primary power is lost, unless specified otherwise in this code. Standby power systems shall automatically provide secondary power within 60 seconds after primary power is lost, unless specified otherwise in this code.

Definitions – The definition for occupied support areas could literally pick up every such room in a building, rather than those supporting the shelter. This term is used in 401.1.1 for floor elevation, 702.1.4, 702.3, 702.3.2, 703.1.5, 703.4, 703.5, 703.6.

702.1.1 – it is adequate for the mechanical system to be on standby power. The possible 90 second delay for standby power to kick in will not be an issue.

702.3– the building code covers emergency lighting, if required, within the shelter. What appears to be wanted here is lights in the shelter while people have to stay in there that are consistent with general means of egress lighting. The current language, by allowing an average, would allow some areas to be totally dark if others had high lighting levels. The proposed language would ask for the same minimum lighting over all as provided for means of egress, which is a general lighting for the space. Lighting outside of the shelter is covered under the IBC. The flashlight exception would was relocated from under standby power requirements to the lighting requirement. No changes to the exception. This is consistent with 703.4.

702.4 (new) and 702.3.1 and 702.3.2 the sections on capacity and duration is under lighting, but seem to have a requirement for mechanical as well. Better to clarify this is for both. Standby power can be battery back up or generators. This will also match the current language for hurricane shelters in 703.6.1 and 703.6.2.

703.1.1 - If there is mechanical ventilation in the hurricane shelter, would you not want it to continue to operate if the building looses power?

703.4 – same comments are 702.3

703.5 – 10 footcandles is what is recommended for general work lighting. Why would this be considered a minimum requirement in a shelter? If you want something this high, put it in 703.4. Or if it is needed for specific areas, phrase it that way.

703.6 – The requirement for the last sentence are moved and clarified in 703.6.1. Not all standby lighting or emergency lighting is a critical branch lighting circuit. That is a term used in healthcare facilities for circuits that directly support patient care. The life safety system is dependent on the building and outside of the scope of the shelter standard.

703.6.1 – clarify what the standby power will support

703.5.2-703.6.5 – consistent terminology – not all power systems are electrical. Use the terminology in the I-codes.

Staff note: Occupant support areas is used in the ICC 500 in Sections 40.1.1, 702.1.4, 702.3, 702.3.2, 703.1.5, 703.4, 703.5, 703.6.

Committee Action: As Modified (8-0)

Further modify as follows:

702.3 Standby lighting. Community tornado shelters shall be provided with a standby lighting system. The standby lighting system shall provide an average illumination level of not less than 1 foot-candle (11 lux) at the walking surface in occupied shelter areas~~,~~ and occupant support areas.

Exception: Personal-use flashlights shall be permitted for the standby lighting system requirement for tornado shelters with an occupant load of less than or equal to 50, when provided at a quantity not less than one (1) flashlight per 10 occupants. Personal-use flashlights with ~~shall be~~ a minimum of ~~two "D" cell size~~ 150 lumens or an approved equivalent lighting device ~~light output~~, and readily available ~~accessible from~~ within the occupied shelter areas or immediately adjacent occupant support areas.

702.4 Standby power. Where required by Section 702.1 or 702.3, Community tornado shelters shall be provided with a standby power system. The standby power system shall support occupied tornado shelter areas~~,~~ and occupant support areas.

703.4 Standby lighting. Community hurricane shelters shall be provided with a standby lighting system. The standby lighting system shall provide an average illumination level of not less than 1 foot-candle (11 lux) at the walking surface in occupied shelter areas~~,~~ and occupant support areas.

Exception: Personal-use flashlights shall be permitted for the standby lighting system requirement for tornado shelters with an occupant load of less than or equal to 50, when provided at a quantity not less than one (1) flashlight per 10 occupants. Personal-use flashlights with ~~shall be~~ a minimum of ~~two "D" cell size~~ 150 lumens or an approved equivalent lighting device ~~light output~~, and readily available ~~accessible from~~ within the occupied shelter areas or immediately adjacent occupant support areas.

703.6 Standby power. Where required by Section 703.1 or 703.4, Community hurricane shelters ~~with a shelter occupant load greater than 50~~ shall be provided with a standby power system. The standby power system shall support occupied hurricane shelter areas and occupant support areas.

Committee Reason: Good coordination and clean up of language. Marches NFPA 70 terminology. Reason for modifications:

Update the exception to Section 702.3 and 702.4 to more modern terminology and allow for other lighting devices. Add "where required" in sections 702.4 and 703.6 reference back to the lighting and mechanical systems.

IS-STM 07-13-18

IS-STM 07-13-18		**Committee action: Approval as Modified**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**14**	**1**	**0**	**0**	**1**
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Ehrlich Vote:		**x**		

Your comment/reason: Editorial modifications to condense the exceptions allowing flashlights or equivalent devices as standby lighting systems and fix non-mandatory language.

Revise as follows:

702.7 Standby lighting. *Community tornado shelters* shall be provided with a standby lighting system. The standby lighting system shall provide illumination levels of not less than 1 foot-candle (11 lux) at the walking surface in *occupied storm shelter areas*, and *occupant support areas*. The standby lighting system shall be connected to a standby power system.

Exception: Personal-use flashlights with a minimum of 150 lumens or approved equivalent lighting devices shall be permitted for the standby lighting system requirement for tornado shelters with a *storm shelter design occupant capacity* of less than 50, when provided at a quantity not less than one (1) flashlight per 10 occupants~~. Personal-use flashlights with a minimum of 150 lumens or an approved equivalent lighting device,~~ and shall be readily available within the *occupied storm shelter areas* or immediately adjacent *occupant support areas*.

703.9 Standby lighting. *Community hurricane shelters* shall be provided with a standby lighting system. The standby lighting system shall provide illumination levels of not less than 1 foot-candle (11 lux) at the walking surface in *occupied storm shelter areas*, and *occupant support areas*. The standby lighting system shall be connected to a standby power system.

Exception: Personal-use flashlights with a minimum of 150 lumens or approved equivalent lighting devices shall be permitted for the standby lighting system requirement for hurricane shelters with a *storm shelter design occupant capacity* of less than 50, when provided at a quantity not less than one (1) flashlight per 10 occupants~~. Personal-use flashlights with a minimum of 150 lumens or an approved equivalent lighting device,~~ and shall be readily available within the *occupied storm shelter areas* or immediately adjacent *occupant support areas*.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason: Do we need to clarify these are required to be within the shelter? Add "storage".

Revise as follows:

OCCUPANT SUPPORT AREAS. ~~The~~ Storm shelter areas required to ensure the health, safety and well-being of occupants. *Occupant support areas* are areas that serve the *storm shelter* and include, but are not limited to, *storm shelter* management, food preparation, water and food storage, storage, electrical and mechanical rooms, toilet and other sanitation rooms and first-aid stations.

Chapter 8
TEST METHODS FOR IMPACT AND PRESSURE TESTING

IS-STM 08-10-18
ICC 500 Section 805.3

Proponent: John Roberts, UL LLC

Revise as follows:

805.3 Cyclic pressure testing after impact. Test specimens requiring cyclic pressure testing to establish the ability to meet the wind pressure requirements set forth in Section 304 of this standard shall be cyclic tested using the loading sequence detailed in Table 1 of ASTM E1886 specified to the design wind pressure as defined in Section 304.1. Pressure testing procedures shall be performed as detailed in Sections 11.1 through 11.2.11 of ASTM E1886.

> **Exception:** The maximum allowable cycle time for specimens over 75 square feet (7 square M) in area shall be permitted to be calculated using the following equation:
> Maximum allowable cycle time = (area of specimen (in sq. ft.) – 75) x (0.06) + 3 seconds.
> In no case shall the maximum cycle time exceed 10 seconds.

Reason:

- It is difficult to test large specimen sizes at a cycle of 1 to 5 seconds as prescribed in ASTM E1886-05, when the volume of air displacement is much larger. Adding the exception provides an alternative allowance for large specimens such as garage doors and very large louver sizes (ex: 10'x10') to be cycle tested with same cycle time as per Miami-Dade Louver checklist allowance.
    - *See the Miami-Dade louver checklist # 0240 below:*

Notes:

1. If the louver has plastic as a component, add the Plastic Checklist to these requirements.
2. The following equation may be used to calculate the allowable cycle time for specimens larger than 75 ft^2 and with a width of more than 20 ft. and/or height of more than 8 ft.
   Maximum allowable cycle time for specimens over
   75 ft^2 = (area of specimen – 75) x (0.06) +3 seconds
   Maximum allowable cycle time for this equation is not to exceed 10 seconds.

- This change helps to maintain consistency within the market that would use these products and their performance while improving the level of consistency of the testing process.

Committee Action: As Modified (11-0)

Further modify as follows:

805.3 Cyclic pressure testing after impact. Test specimens requiring cyclic pressure testing to establish the ability to meet the wind pressure requirements set forth in Section 304 of this standard shall be cyclic tested using the loading sequence detailed in Table 1 of ASTM E1886 specified to the design wind pressure as defined in Section 304.1. Pressure testing procedures shall be performed as detailed in Sections 11.1 through 11.2.11 of ASTM E1886.

Exception: The maximum allowable cycle time for specimens over 75 square feet (7 square M) in area shall be permitted to be calculated using the following equation:
Maximum allowable cycle time in seconds = (area of specimen (in sq. ft.) – 75) x (0.06) + 3 ~~seconds~~.
In no case shall the maximum cycle time exceed 10 seconds.

Committee Reason: Modification is to address units (i.e. seconds). The WG recognizes that cyclic pressure testing of larger specimens requires movement of significantly greater volumes of air. As such, the prescriptive cycle of 1 to 5 seconds as prescribed in ASTM E1886-05 is not feasible. The proposed language establishes an equation creating a relationship between time allowed and air volume associated with a given size specimen.

IS-STM 08-10-18

IS-STM 08-10-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	0
Staff Notes: Does “allowable cycle time” have a nomenclature in ASTM E1886 that we should use here?					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with	Negative with	Abstain with

		comment	comment	reason
Scott Vote:		**x**		

Your comment/reason: Editorial – in the exception to Section 804.3, the "(7 square M)" should be "(7 m^s)" also has mix of "square feet" and "sq. ft."

Modify as follows:

(IS-STM 08-08-18 AM, IS-STM 08-09-18 AM, IS-STM 08-10-18 AM, IS-STM 08-15-18 AS) (IS-STM 03-11-18 AM)

804.3 Cyclic pressure testing after impact. Test *specimen*s requiring cyclic pressure testing shall be cyclic tested in accordance with ASTM E1886 using the loading sequence detailed in Table 1 of ASTM E1886 to the *design wind pressure*. The test *specimen*s used shall be the same test *specimen*s that received impacts in accordance with Section 804. Cyclic pressure testing procedures shall be performed in accordance with the Air Pressure Cycling criteria as detailed in ASTM E1886.

Exception: The maximum allowable cycle time for *specimen*s over 75 square feet (7 ~~square M~~ m^2) in area shall be permitted to be calculated using the following equation:

Maximum allowable cycle time in seconds = (area of *specimen* ~~(~~in sq. ft.~~)~~ – 75) x ~~(~~0.06~~)~~ + 3

In no case shall the maximum cycle time exceed 10 seconds.

IS-STM 08-14-18
ICC 500 Section 806.5

Proponent: John Roberts, UL LLC

Revise as follows:

806.5 Impact-protective systems. External impact-protective systems shall be tested for the ability to withstand prescribed pressures if withstanding pressure is critical to their function when installed. Devices such as nonoperable, permanently affixed shields or cowlings whose only function is to protect against debris intrusion need not be static or cyclic (hurricane shelter) pressure tested when the shields or cowlings have been designed and anchored to resist the design loads as determined in this standard.

Reason:
- This change provides clarity to the requirements of pressure testing exclusions to include cyclic when being used for a hurricane shelter component.
- This also removes some subjectivity and improves the standard for repeatability and consistency of the testing process, for an accredited testing laboratory.

Staff note: While cyclic pressure testing may only be applicable for hurricane shelters "(hurricane shelter)" does not technically indicate that limitation. The testing and how it is applied is addressed in Section 805.

Committee Action: As Modified (6-1 – meeting)(10-1 electronic vote)

Further modify as follows:

806.5 Impact-protective systems. External impact-protective systems shall be tested for the ability to withstand prescribed pressures if withstanding pressure is critical to their function when installed. Devices such as nonoperable, permanently affixed shields or cowlings whose only function is to protect against debris intrusion need not be static or cyclic ~~(hurricane shelter)~~ pressure tested when the shields or cowlings have been designed and anchored to resist the design loads as determined in this standard.

Committee Reason: The modification is to remove "(hurricane shelter)" because it has no technical requirements. The added words clarify what type of pressures is exempted.
The work group should look at removal of "pressures if withstanding pressure is critical to their function when installed" as a separate proposal.

IS-STM 08-14-18

IS-STM 08-14-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	15	0	0	0	1

Staff Notes:

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Holstein PC		x		

Your comment/reason: Full term is for section heading should be “impact-protective systems”.

Language is required to clarify that impact protective systems for hurricane shelters must be designed for cyclic loads after impact as well as static pressure loads.

Modify as follows:

805.5 Other *impact-protective systems*. Where installed, other external *impact-protective systems* shall be tested for the ability to withstand prescribed pressures where withstanding pressure is critical to their function. Where the only function of devices such as nonoperable, permanently affixed shields or cowlings, is to protect against debris intrusion, such devices need not be static or cyclic pressure tested where the shields or cowlings have been designed and anchored to resist the static and dynamic design loads as determined in this standard.

IS-STM 08-16-18
ICC 500 Sections 202. 802

Proponent: ICC 500

Delete the following:

~~**SECTION 802**~~
~~**TERMINOLOGY**~~

~~**802.1 General terminology.** General terminology of building construction used in this test method is defined in ASTM E631.~~

~~**802.2 Definitions of terms specific to this test method.**~~

~~**IMPACT-PROTECTIVE SYSTEM.** A system or device such as a shutter, door or other device mounted on the inside or outside of the exterior wall of a *shelter* that has been demonstrated by testing to be capable of withstanding the impact of test missiles as detailed in this standard.~~

~~**SPECIMEN.** The entire assembled unit submitted for test, including but not limited to anchorage devices and structure to which product is to be mounted.~~

~~**TEST CHAMBER.** An airtight enclosure of sufficient depth to allow unobstructed deflection of the specimen during pressure cycling, including ports for air supply and removal, and equipped with instruments to measure test pressure differentials.~~

~~ASTM E631—06 Terminology of Building Constructions .....802.1~~

(Renumber subsequent sections)

Relocate the definitions:

SECTION 202
DEFINITIONS

SPECIMEN. The entire assembled unit submitted for testing, including but not limited to anchorage devices and structure to which the product is to be mounted.

TEST CHAMBER. An airtight enclosure of sufficient depth to allow unobstructed deflection of the specimen during pressure cycling, including ports for air supply and removal, and equipped with instruments to measure test pressure differentials.

Reason: The intent is to move the definitions in Section 802.2 to Chapter 2. These are the only definitions in the standard not in Chapter 2.

Work Group 8 believes that the revised definition for 'impact-protective system' worked out in Chapter 2, should be the definition for the entire standard, so this is just deleting the definition in Chapter 8, not the definition for impact protective system in Chapter 2.

The reference to ASTM E631 is not needed, and Section 802.1 is the only reference.

The definition in Chapter 2 has been revised as follows:

(IS-STM 02-08-18-AM)

IMPACT-PROTECTIVE SYSTEM. A system or device, subject to pressure and impact testing as detailed in this standard, installed to protect an opening in a roof, wall or floor

of the *storm shelter envelope* ~~that is capable of withstanding pressure and impact testing as detailed in this standard~~.

Committee Action: As submitted (6-0) 2 abstain – meeting (11-0 electronic vote)

Committee Reason: Agree with proponents reason. This is editorial.

IS-STM 08-16-18

IS-STM 08-16-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	15	0	0	0	1
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Dain PC		x		

Your comment/reason: How do you provide the structure as part of the specimen?

Revise as follows:

SPECIMEN. The entire assembled unit submitted for testing, including but not limited to anchorage devices ~~and structure~~ to which the product is to be mounted.

IS-STM 08-17-18

ICC 500 Sections 202. 306.5, 804.9, 804.9.4, 809.4.5, 804.9.6, 806.1, 806.5, 806.5.1, 806.5.2, 806.6

Proponent: ICC 500

Revise as follows:

IMPACT-PROTECTIVE SYSTEM. A system or device, subject to pressure and impact testing as detailed in this standard, installed to protect an opening in a roof, wall or floor of the *storm shelter envelope* ~~that is capable of withstanding pressure and impact testing as detailed in this standard~~. , such as door assemblies, window assemblies and other devices to protect openings.

SECTION 804
MISSILE IMPACT TESTING

804.3 Missile impact procedure. Test specimens shall be impact tested with test missiles of size and speed as specified in Section 305 of this standard. Impact procedure shall be performed as detailed in Sections 11.1 through 11.3 of ASTM E1886. The minimum number of impact locations shall be as detailed in Section 804.9.

804.9 Impact locations and the number of impacts. For purposes of testing wall assemblies, roof assemblies and impact-protective systems, Impacts are to be located as indicated in ~~the following sections~~ Sections 804.9.1 through 804.9.7.3, as applicable:

804.9.1 Panel or framed walls/roofs.

FIGURE 804.9.1(1)
PANEL OR FRAMED WALLS/ROOF

FIGURE 804.9.1(2)
PANEL OR FRAMED WALLS/ROOF

804.9.2 Solid wall/roof sections of concrete or other materials.

FIGURE 804.9.2(1)
SOLID WALLS/ROOF SECTION OF CONCRETE OR OTHER MATERIALS

FIGURE 804.9.2(2)
SOLID WALLS/ROOF SECTION OF CONCRETE OR OTHER MATERIALS

804.9.3 Masonry unit walls/roofs.

FIGURE 804.9.3(1)
MASONRY UNIT WALLS/ROOFS

FIGURE 804.9.3(2)
MASONRY UNIT WALLS/ROOFS

804.9.4 ~~804.9.5~~ Doors or other entry/egress systems. All door assemblies and other entry~~/~~ **and** egress systems shall be impacted within 6 inches (152.4 mm) of an interface hinge joint, within 6 inches (152.4 mm) of an upper latch point and within 6 inches (152.4 mm) of center primary latches or operators as shown in Figure 804.9.4 ~~804.9.5~~ (1).

For double door assemblies, a single door leaf shall receive three impacts as shown in Figure 804.9.4 ~~804.9.5~~ (2) plus an additional impact on a center meeting point or mullion.

Where the door contains glazed openings with a size less than or equal to 12 inches (305 mm) by 12 inches (305 mm), an additional sample shall be impacted in the center of the glazed opening. Where glazed openings have a dimension greater than 12 inches (305 mm), the glazed opening shall be treated as a window and tested in accordance with Section 804.9.4 ~~of this standard~~.

FIGURE 804.9.4 ~~804.9.5~~ (1)
DOORS AND OTHER ENTRY/EGRESS SYSTEMS

FIGURE 804.9.4 ~~804.9.5~~ (2)
DOORS AND OTHER ENTRY/EGRESS SYSTEMS

804.9.5 ~~804.9.4~~ Windows and other glazed openings. All window assemblies and other glazed openings shall be impacted in the center of the smallest glazed section, and at one interface corner as detailed in Figure 804.9.5 ~~804.9.4~~ (1). Where interior mullions or other glazed section joints and/or latches are present, additional impacts shall be applied on these features as shown in Figure 804.9.5 ~~804.9.4~~ (2).

No more than two impacts shall be made on one specimen. Where more than two impacts are required, multiple identical test specimens shall be provided.

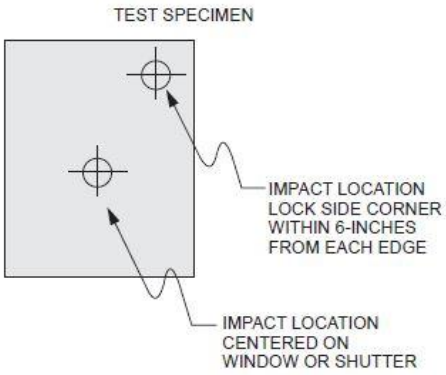
Exception: More than two impacts may be made on a test specimen by mutual consent of owner and test laboratory.

FIGURE 804.9.5 ~~804.9.4~~ (1)
WINDOWS AND OTHER GLAZED OPENINGS

FIGURE 804.9.5 ~~804.9.4~~ (2)
WINDOWS AND OTHER GLAZED OPENINGS

804.9.6 Other *Impact-protective systems*. All ~~shutter assemblies and~~ other *impact-protective 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. All ~~shutter assemblies and~~ impact protection systems that include swinging door assemblies with latching hardware shall be tested in accordance with Section 804.9.5.

Where an interior stud or support is present, additional impacts shall be performed within 3 inches (76.2 mm) of the stud~~/~~ and support, and directly on the stud support, as detailed in Figure 804.9.2(1) or 804.9.2(2).



For SI: 1 inch = 25.4 mm.

FIGURE 804.9.6(1)
SHUTTERS OR OTHER IMPACT PROTECTION SYSTEMS

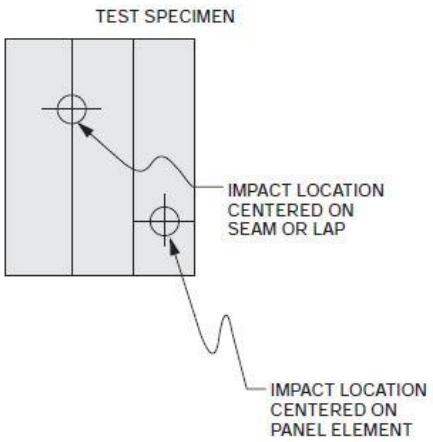


FIGURE 804.9.6(2)
SHUTTERS OR OTHER IMPACT PROTECTION SYSTEMS

FIGURE 804.9.6(1)
~~SHUTTERS OR~~ OTHER IMPACT PROTECTION SYSTEMS

FIGURE 804.9.6(2)
~~SHUTTERS OR~~ OTHER IMPACT PROTECTION SYSTEMS

804.9.7 Alcove or baffled entry systems.

FIGURE 804.9.7
ALCOVE/BAFFLED ENTRY SYSTEM

804.9.7.1 1 Alcove/baffled entry systems for which no testing is required.

FIGURE 804.9.7.1
ALCOVE/BAFFLED ENTRY SYSTEMS FOR WHICH NO DOOR IS REQUIRED

804.9.7.2 Door subject to rebound impact.

FIGURE 804.9.7.2
DOORS SUBJECT TO REBOUND IMPACT

804.9.7.3 Door subject to first impact.

FIGURE 804.9.7.3
DOORS SUBJECT TO FIRST IMPACT

SECTION 806
PRESSURE TESTING PROCEDURES

806.1 Pressure testing procedures. Procedures for pressure testing wall assemblies, roof assemblies, ~~door assemblies, window assemblies~~ and *impact-protective systems* requiring pressure testing are presented ~~in this section~~ in Sections 806.2 through 806.6, as applicable.

806.2 Roof and wall assemblies..

806.3 Door assemblies.

806.3.1 Door assemblies without glazing.

806.3.1.1 Door assemblies without glazing for *tornado shelters*.

806.3.1.2 Door assemblies without glazing for *hurricane shelters*.

806.3.2 Door assemblies with glazing, sidelights or transoms.

806.3.2.1 Door assemblies with glazing, sidelights or transoms for *tornado shelters*.

806.3.2.2 Door assemblies with glazing, sidelights or transoms for *hurricane shelters*.

806.4 Window assemblies and other glazed openings.

806.4.1 Window assemblies and other glazed openings for *tornado shelters*.

806.4.2 Window assemblies and other glazed openings for *hurricane shelters*.

806.5 Other *Impact-protective systems*. Other external *impact-protective systems* shall be tested for the ability to withstand prescribed pressures ~~if~~ withstanding pressure is critical to their function when installed. devices such as nonoperable, permanently affixed shields or cowlings whose only function is to protect against debris intrusion need not be pressure tested when the shields or cowlings have been designed and anchored to resist the design loads as determined in this standard.

806.5.1 Other *Impact-protective systems* for *tornado shelters*. Other external *impact-protective systems* 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* with a jamb or stop need to be tested with pressure only away from the stop.

806.5.2 ~~Opening~~ Other *Impact-protective systems* ~~devices~~ for *hurricane shelters*. Other external impact-*protective systems* ~~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 *hurricane shelter design wind pressures* specified in Section 304 following the procedures specified in ASTM E330. Cyclic pressure tests conducted in accordance with Section 805.5 shall be conducted after debris impact tests.

806.6 *Alcove or baffled storm shelter entry systems*. Any element of the *alcove or baffled storm shelter entry system* whose ability to resist wind-induced pressure is critical to the function of the *alcove or baffled storm shelter entry system* shall be designed to meet the requirements of Section 304 or shall be pressure tested in accordance with Section 806.

Correlating references and terms in Chapter 8

PROTECTED OCCUPANT AREA. The portions of the *shelter* area that are protected from intrusion of storm debris by *alcove or baffled entry systems* in accordance with Section 804.9.7.

306.5 *Alcove or baffled storm shelter entry systems*. All protective elements of *alcove or baffled storm shelter entry systems* shall be designed to meet the wind load requirements of Section 304 and the debris impact test requirements of Section 305. Where a door is employed as part of the protection in such an entry system, the door shall meet the debris impact test requirements of Section 804.9.7 and the pressure testing requirements of Sections 805 and 806.6. The enclosure classification for *storm shelters* with ~~baffled or~~ *alcove or baffled storm shelter entry systems* ~~entries~~ shall be determined in accordance with Section 304.6.

Exception: When the entry system for a *residential shelter* is equipped with a door assembly that meets the pressure requirements of Section 304, the enclosure classification shall remain unchanged by the *alcove or baffled storm shelter entry system*.

Reason: The main concern is to separate doors and windows from other opening protective systems. The relocation is to have the same order, walls, roofs, doors windows, other impact-protective systems, alcove or baffled storm shelter entry. Not sure where alcove and baffled entry system fits in – other than maybe an alternative?

Need to check Chapter 3 for correct references for impact testing and pressure testing. Not sure what consistent terms to use for pressure.

Committee Action: As Submitted (6-0 meeting) (11-0 electronic vote)

Committee Reason: See proponents reason. May not need laundry

IS-STM 08-17-18

IS-STM 08-17-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	1
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:			x	

Your comment/reason: Negative on the definition of impact protective system. The new definition is confusing, particularly the phrase and placement of "such as door assemblies, window assemblies and other devices to protect openings." Are these supposed to be examples of impact protective systems, or opening protective systems, or systems that need protection? Fix by adding a definition of openings, and then reference 'openings' as an italicized term here in this definition.

No specific revisions suggested.

IMPACT-PROTECTIVE SYSTEM. A system or device, subject to pressure and impact testing as

detailed in this standard, installed to protect an opening in a roof, wall or floor of the *storm shelter envelope,* such as door assemblies, window assemblies and other devices to protect openings.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC		**x**		

Your comment/reason: Add “systems or”.

Revise as follows:

IMPACT-PROTECTIVE SYSTEM. A system or device, subject to pressure and impact testing as detailed in this standard, installed to protect an opening in a roof, wall or floor of the *storm shelter envelope*, such as door assemblies, window assemblies, and other systems or devices to protect openings.

IS-STM 08-18-18
ICC 500 Sections 304.6, 306.5, 306.7 803.1, 804.9, 806

Proponent: ICC 500

Revise as follows:

304.6 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~~ impact protective system on a wall that receives positive external pressure shall be considered as an opening.

306.3.1 Testing of *storm shelter* door assemblies. Door assemblies for use in the *storm shelter envelope* shall be tested in accordance with missile impact and pressure test procedures described in Chapter 8.

306.5 A*lcove or baffled* *storm shelter* *entry systems*. All protective elements of *alcove or baffled storm shelter entry systems* shall be designed to meet the wind load requirements of Section 304 and the debris impact test requirements of Section 305. Where a door assembly is employed as part of the protection in such an entry system, the door assembly shall meet the debris impact test requirements of Section 804.9.7 and the pressure testing requirements of Sections 805 and 806.6. The enclosure classification for *storm shelter*s with ~~baffled or~~ *alcove or baffled storm shelter entry systems* ~~entries~~ shall be determined in accordance with Section 304.6.

Exception: When the entry system for a *residential storm shelter* is equipped with a door assembly that meets the pressure requirements of Section 304, the enclosure classification shall remain unchanged by the *alcove or baffled storm shelter entry system*.

306.7 Door undercut. Door ~~or shutter~~ assemblies for use in the *storm shelter envelope* with a threshold at the level of exit discharge shall be limited to a 3/4-inch (19.1 mm) maximum undercut. A weather seal at the door undercut where doors are exposed to weather shall be provided.

SECTION 803
TEST SPECIMENS

803.1 Test assembly. 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 *storm 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 (1219 mm) 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 mm) wide and the full length of the span of the wall section from support to support.

~~Doors, windows and~~ *Impact-protective systems* are to be tested at the maximum and minimum size listed for use. Operable ~~doors or windows~~ door assemblies and window assemblies 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 *storm shelter*, and shall contain all devices used to resist wind forces and wind-borne debris. When it is not practical to install for testing ~~a door or window frame~~ door assemblies and window assemblies as it will be mounted in a *storm shelter*, then the unit or assembly shall be mounted in a test buck to connect the specimen to the test ~~frame/stand/chamber~~ frame, stand or chamber. Details of the mounting shall be described in the test report.

804.9 Impact locations and the number of impacts. Impacts are to be located as indicated in the following sections:

804.9.1 Panel or framed ~~walls/roofs~~ wall assemblies and roof assemblies. Sections of Panel or framed wall assemblies and roof assemblies ~~sections~~ shall be impacted in the center of the ~~wall/roof~~ section, and at one interface corner as detailed in Figures 804.9.1(1) and 804.9.1(2).

When an interior stud or support is present, additional impacts shall be performed near the stud~~/~~ or support, and directly on the stud support, as detailed in Figures 804.9.1(1) and 804.9.1(2).

Interface joints used for attachment or joining at corners, at panel-to-panel sections, or at panel-to-roof shall be impacted directly on the interface joints as detailed in Figure 804.9.1(2) for each type of joint.

When a section contains lapped materials, the centered impact shall be adjusted to strike the center of any lap, and an additional impact shall be performed beside the lap on the panel that laps behind the seam as detailed in Figure 804.9.1(2).

No more than three impacts shall be made on one specimen. Where more than three impacts are required, multiple identical test specimens shall be provided.

Exception: More than three impacts may be made on a test specimen by mutual consent of owner and test laboratory.

FIGURE 804.9.1(1)
PANEL OR FRAMED ~~WALLS/ROOF~~ WALL ASSEMBLIES AND ROOF ASSEMBLIES

FIGURE 804.9.1(2)
PANEL OR FRAMED ~~WALLS/ROOF~~ WALL ASSEMBLIES AND ROOF ASSEMBLIES

804.9.2 Solid wall assemblies and roof assemblies ~~walls/roofs sections~~ of concrete or other materials. Sections of Wall assemblies and roof assemblies ~~sections~~ of solid concrete or other solid material shall be impacted in the center of the ~~wall/roof~~ section, and at one interface corner as detailed in Figures 804.9.2(1) and 804.9.2(2). When interface joints are used for joining at corners or panel-to-panel joints, an additional section shall be impacted directly on the interface joints as detailed in Figure 804.9.2(2).

Where an interior stud or support is present, additional impacts shall be performed within 3 inches (76.2 mm) of the stud~~/~~ and support, and directly on the stud support as detailed in Figures 804.9.2(1) and 804.9.2(2).

No more than three impacts shall be made on one specimen. Where more than three impacts are required, multiple identical test specimens shall be provided.

Exception: More than three impacts ~~may~~ be made on a test specimen by mutual consent of owner and test laboratory.

FIGURE 804.9.2(1)
SOLID ~~WALLS/ROOF SECTION~~ WALL ASSEMBLIES AND ROOF ASSEMBLIES OF CONCRETE OR OTHER MATERIALS

FIGURE 804.9.2(2)
SOLID ~~WALLS/ROOF SECTION~~ WALL ASSEMBLIES AND ROOF ASSEMBLIES OF CONCRETE OR OTHER MATERIALS

804.9.3 Masonry unit ~~walls/roofs~~ wall assemblies and roof assemblies. ~~Walls and roof sections~~ Section of wall assemblies and roof assemblies constructed of masonry units shall be impacted in the center of the ~~wall/roof~~ section, and at one interface corner or joint as detailed in Figure 804.9.3(1). Mortared joints shall be impacted directly on the interface joints as detailed in Figure 804.9.3(2).

No more than three impacts shall be made on one specimen or specimen panel. Where more than three impacts are required, multiple identical test specimens shall be provided.

Exception: More than three impacts may be made on a test specimen by mutual consent of owner and test laboratory.

FIGURE 804.9.3(1)
MASONRY UNIT ~~WALLS/ROOFS~~ WALL ASSEMBLIES AND ROOF ASSEMBLIES

FIGURE 804.9.3(2)
MASONRY UNIT ~~WALLS/ROOFS~~ WALL ASSEMBLIES AND ROOF ASSEMBLIES

804.9.4 ~~Windows~~ Window assemblies and other glazed openings. All window assemblies and other glazed openings shall be impacted in the center of the smallest glazed section, and at one interface corner as detailed in Figure 804.9.4(1). Where interior mullions or other glazed section joints ~~and/~~or latches are present, additional impacts shall be applied on these features as shown in Figure 804.9.4(2).

No more than two impacts shall be made on one specimen. Where more than two impacts are required, multiple identical test specimens shall be provided.

Exception: More than two impacts may be made on a test specimen by mutual consent of owner and test laboratory.

FIGURE 804.9.4(1)
~~WINDOWS~~ WINDOW ASSEMBLIES AND OTHER GLAZED OPENINGS

FIGURE 804.9.4(2)
~~WINDOWS~~ WINDOW ASSEMBLIES AND OTHER GLAZED OPENINGS

804.9.5 All door **~~Doors~~ Door assemblies or other entry~~/~~ and egress systems.** assemblies and other entry~~/~~ **and** egress systems shall be impacted within 6 inches (152.4 mm) of an interface hinge joint, within 6 inches (152.4 mm) of an upper latch point and within 6 inches (152.4 mm) of center primary latches or operators as shown in Figure 804.9.5(1).

For double door assemblies, a single door leaf shall receive three impacts as shown in Figure 804.9.5(2) plus an additional impact on a center meeting point or mullion.

Where the door assemblies contains glazed openings with a size less than or equal to 12 inches (305 mm) by 12 inches (305 mm), an additional sample shall be impacted in the center of the glazed opening. Where glazed openings have a dimension greater than 12 inches (305 mm), the glazed opening shall be treated as a window assembly and tested in accordance with Section 804.9.4 of this standard.

FIGURE 804.9.5(1)
~~DOORS~~ DOOR ASSEMBLIES AND OTHER ENTRY~~/~~ AND EGRESS SYSTEMS

FIGURE 804.9.5(2)
~~DOORS~~ DOOR ASSEMBLIES AND OTHER ENTRY~~/~~ AND EGRESS SYSTEMS

804.9.6 Other *Impact-protective systems*. All ~~shutter assemblies and~~ other *impact-protective 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. All ~~shutter assemblies and~~ impact protection systems that include swinging door assemblies with latching hardware shall be tested in accordance with Section 804.9.5.

Where an interior stud or support is present, additional impacts shall be performed within 3 inches (76.2 mm) of the stud~~/~~ **or** support, and directly on the stud support, as detailed in Figure 804.9.2(1) or 804.9.2(2).

FIGURE 804.9.6(1)
~~SHUTTERS OR~~ OTHER IMPACT PROTECTION SYSTEMS

FIGURE 804.9.6(2)
~~SHUTTERS OR~~ OTHER IMPACT PROTECTION SYSTEMS

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

1. Storm debris impacts at least two *impact-protective systems* 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 *storm shelter*.
2. Storm debris impacts initially an *impact-protective system* meeting the requirements of Section 306.2 and possibly rebounds to impact ~~an entry door~~ a door assembly. 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 804.9.7.2. Examples of this type of system are shown in Figures 804.9.7.1 and 804.9.7.2.
3. Storm debris impact on ~~an entry door~~ a door assembly is limited to an angle less than 90 degrees (1.57 rad) by *impact-protective systems*. The debris test requirements for this type of system are presented in Section 804.9.7.3. Examples of this type of system are shown in Figure 804.9.7.3.

FIGURE 804.9.7
ALCOVE~~/~~ OR BAFFLED STORM SHELTER ENTRY SYSTEM

804.9.7.1 *Alcove~~/~~ or baffled storm shelter entry systems* for which no testing is required. *Storm shelter* entrances, whether provided with a door assembly or not, that are protected by an *alcove or baffled storm shelter entry system* that require missiles to impact at least two surfaces meeting the requirements of Section 306.2 prior to arriving at the *protected occupant area* shall not be required to undergo debris impact testing. See Figure 804.9.7.1. When a solid door assembly is installed as a closure for this type of entry system, the door assembly need not meet the wind load requirements of Section 304.

FIGURE 804.9.7.1
***ALCOVE~~/~~ OR BAFFLED STORM SHELTER ENTRY SYSTEMS* FOR WHICH NO DOOR IS REQUIRED**

804.9.7.2 Door assembly subject to rebound impact. Where the *alcove or baffled storm shelter entry system* prevents a first impact of the design missile on the door assembly but the door assembly is subject to a ~~rebounded~~ *rebound impact* of the design missile after it has impacted one surface meeting the requirements of Section 306.2 (see Figure 804.9.7.2), then a door assembly shall meet the wind load requirements of Section 304 and the debris impact requirements of Section 305 except that the missile shall be, at a minimum, a 9-pound sawn lumber 2 by 4 traveling at 50 feet per second (15.2 m/s). Entry systems having ~~doors~~ door assemblies that are protected from the initial and first ~~rebounded~~ *rebound impacts* of debris shall comply with the requirements of Section 804.9.7.1.

FIGURE 804.9.7.2
~~DOORS~~ DOOR ASSEMBLIES SUBJECT TO REBOUND IMPACT

804.9.7.3 Door assemblies subject to first impact. If a first-strike angle missile impact on the door assembly is possible (see Figure 804.9.7.3) then the door assembly is deemed suitable if the door assembly meets the wind load requirements of Section 304 and the door assembly meets one of the following debris impact criteria:

1. The door assembly withstands the impact of a missile specified in Section 305 striking the door assembly at an angle closest to perpendicular to the plane of the door assembly that the missile might strike in the *storm shelter* application; or

2. The door assembly is tested following procedures specified in Section 305 or a door assembly is selected that has withstood missile impacts by the design missile striking perpendicular to the surface with speed equal to or greater than the *storm shelter* design missile's velocity component perpendicular to the door assembly for the most critical angle that can occur in the application.

The minimum debris impact criterion for the door assembly shall be an impact perpendicular to the door assembly of a 9-pound sawn lumber 2 by 4 traveling at 50 feet per second [34 mph (15.2 m/s)].

FIGURE 804.9.7.3
~~DOORS~~ DOOR ASSEMBLY SUBJECT TO FIRST IMPACT

804.10 Pass fail.

804.10.1 Perforation.

804.10.2 Dislodgment and disengagement.

804.10.3 Spall.

804.10.4 Permanent deformation.

SECTION 806
PRESSURE TESTING PROCEDURES

806.1 Pressure testing procedures. Procedures for pressure testing wall assemblies, roof assemblies, door assemblies, window assemblies and *impact-protective systems* requiring pressure testing are presented ~~in this section~~ in Sections 806.2 through 806.6, as applicable.

806.2 ~~Roof and~~ wall assemblies and roof ~~and wall~~ assemblies. When testing of wall assemblies and roof ~~and wall~~ assemblies is required, they shall be pressure tested in the as-supplied condition. Required pressure testing shall be done as detailed in ASTM E330 to a pressure equal to or higher than 1.2 times the pressures specified in Section **304**.

806.3 Door assemblies. Door assemblies shall be pressure tested in the as-supplied condition and, when required, they shall be static pressure tested or cyclically tested as specified in the required, they shall be **static pressure** tested or **cyclically** tested as specified in the following sections:

806.3.1 Door assemblies without glazing. Door assemblies without glazing that require testing to meet the qualification of Section 306.3 shall be pressure tested according to procedures specified in ~~this section~~ Sections 806.3.1.1 and 806.3.1.2.

806.3.1.1 Door assemblies without glazing for *tornado shelters*. Door assemblies without glazing for use in *tornado shelters* shall be static pressure tested away from the door stops to a pressure of at least 1.2 times the pressures specified in Section **304**. Pressure tests are permitted to be conducted separately from missile impact tests.

806.3.1.2 Door assemblies without glazing for *hurricane shelters*. Door assemblies without glazing for use in *hurricane shelters* shall be static pressure proof tested away from the door stops to a pressure of at least 1.2 times the *design wind pressure*, then subjected to required debris impact tests, and then to cyclic pressure tests following procedures of ASTM E1886.

Alternatively, door assemblies without glazing for *hurricane shelters* shall be statically pressure tested away from the door stops to a pressure of 1.5 times the *design wind pressure* before impact tests and then to required debris impact tests. Cyclic pressure testing after impact tests is not

required for these door assemblies that have been pressure tested to pressures equal to or greater than 1.5 times the *design wind pressure*.

806.3.2 Door assemblies with glazing, sidelights or transoms. Door assemblies with glazing, sidelights or transoms shall be pressure tested according to procedures specified in ~~this section~~ Sections 806.3.2.1 and 806.3.2.2. Where glazed openings are present, with a size of less than or equal to 12 inches by 12 inches (304.8 mm by 304.8 mm), an additional sample shall be impacted in the center of the glazed opening in accordance with Section 804 and cyclic pressure tested as detailed in Section 805.3. Where glazed openings have a dimension greater than 12 inches (304.8 mm), the glazed opening shall be treated as a window and tested in accordance with Section 806.5 of this standard.

806.3.2.1 Door assemblies with glazing, sidelights or transoms for *tornado shelters*. Door assemblies with glazing, sidelights or transoms for *tornado shelters* shall be static pressure tested away from the door stops following procedures of ASTM E330 to a pressure of at least 1.2 times the pressures specified in Section 304. Pressure tests are permitted to be conducted separately from debris impact tests.

806.3.2.2 Door assemblies with glazing, sidelights or transoms for *hurricane shelters*. Door assemblies with glazing, sidelights or transoms for *hurricane shelters* shall be static pressure proof tested away from the door stops to a pressure of at least 1.2 times the *design wind pressure*. Any required debris impact tests shall follow pressure proof testing. After impact tests the door assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886.

806.4 Window assemblies and other glazed openings. Window assemblies and other glazed openings shall be pressure tested according to procedures specified in ~~this section~~ Sections 806.4.1 and 806.4.2..

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 ASTM E330. Pressure tests are allowed to be conducted separately from debris impact tests.

806.4.2 Window assemblies and other glazed openings for *hurricane shelters*. Window assemblies and other glazed openings for *hurricane shelters* shall be static pressure tested away from stops to a pressure of at least 1.2 times the *design wind pressure*. Any required debris impact tests shall follow pressure proof testing. After impact tests the window assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886.

806.5 *Impact-protective systems*.

806.5.1 *Impact-protective systems* for *tornado shelters*.

806.5.2 Opening protective devices for *hurricane shelters*.

806.6 *Alcove or baffled storm shelter entry systems*. Any element of the *alcove or baffled storm shelter entry system* whose ability to resist wind-induced pressure is critical to the function of the *alcove or baffled storm shelter entry system* shall be designed to meet the requirements of Section 304 or shall be pressure tested in accordance with Section 806.

Reason: The provisions for impact testing and pressure testing are inconsistent in the terminology for wall assemblies, roof assemblies, door assemblies and window assemblies. The term is in red to make it easier to spot.

Committee Action: As Submitted (6-0 meeting) (11-0 electronic vote)

Committee Reason: Editorial

IS-STM 08-18-18

IS-STM 08-18-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	13	2	0	0	0
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		

Your comment/reason: I know this was supposed to be a largely editorial change, but reading the ballot draft has raised numerous questions:

(1) What is a "panel wall assembly" or "panel roof assembly" and how is it different than a "framed wall assembly" or "framed roof assembly?" A light-framed wall or roof assembly can be field-framed ("stick-built") or constructed in panels in the factory that are shipped to the job site for assembly. I think the correct term would be something like "Light-frame wall assemblies and roof assemblies", with a definition added that can clarify this includes prefabricated panels of light-frame construction. Note the IBC defines "light-frame construction" as "a type of construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members."

Staff note- See blue highlight for text in Section 803.9.1. This phrase was not part of revisions.

(2) What qualify as "other materials" as equivalent to solid walls of concrete? The following sections on masonry walls have no qualifier. Are those sections intended for hollow masonry and this one for solid masonry? Where do ICFs fall? Is that what is intended by other materials?

Staff note- See blue highlight for text in Section 803.9.2. This phrase was not part of revisions.

(3) What about CLT or other mass timber systems? Are they considered panels? Do they perform more like a solid wall?

Finally, can we just say "wall and roof assemblies" rather than "wall assemblies and roof assemblies?" The latter phrasing is awkward to read.

No specific revisions suggested. Highlights are related to comments.

803.9.1 Panel or framed wall ~~assemblies~~ and roof assemblies. Sections of panel or framed wall ~~assemblies~~ and roof assemblies shall be impacted in the center of the section, and at one interface corner as detailed in Figures 803.9.1(1) and 803.9.1(2).

Where an interior stud or support is present, additional impacts shall be performed near the stud/ or support, and directly on the stud support, as detailed in Figures 803.9.1(1) and 803.9.1(2).

Interface joints used for attachment or joining at corners, at panel-to-panel sections, or at panel-to-

roof shall be impacted directly on the interface joints as detailed in Figure 803.9.1(2) for each type of joint.

Where a section contains lapped materials, the centered impact shall be adjusted to strike the center of any lap, and an additional impact shall be performed beside the lap on the panel that laps behind the seam as detailed in Figure 803.9.1(2).

No more than three impacts shall be made on one *specimen*. Where more than three impacts are required, multiple identical test *specimens* shall be provided.

Exception: More than three impacts shall be permitted to be made on a test *specimen* by mutual consent of test sponsor and *test laboratory*.

FIGURE 803.9.1(1)
PANEL OR FRAMED WALL ~~ASSEMBLIES~~ AND ROOF ASSEMBLIES

FIGURE 803.9.1(2)
PANEL OR FRAMED WALL ~~ASSEMBLIES~~ AND ROOF ASSEMBLIES

803.9.2 Solid wall assemblies and roof assemblies of concrete or other materials. Sections of wall ~~assemblies~~ and roof assemblies of solid concrete or other solid material shall be impacted in the center of the section, and at one interface corner as detailed in Figures 803.9.2(1) and 803.9.2(2). Where interface joints are used for joining at corners or panel-to-panel joints, an additional section shall be impacted directly on the interface joints as detailed in Figure 803.9.2(2).

Where an interior stud or support is present, additional impacts shall be performed within 3 inches (76.2 mm) of the stud and support, and directly on the stud support as detailed in Figures 803.9.2(1) and 803.9.2(2).

No more than three impacts shall be made on one *specimen*. Where more than three impacts are required, multiple identical test *specimens* shall be provided.

Exception: More than three impacts shall be permitted to be made on a test *specimen* by mutual consent of test sponsor and *test laboratory*.

FIGURE 803.9.2(1)
SOLID WALL ~~ASSEMBLIES~~ AND ROOF ASSEMBLIES OF CONCRETE OR OTHER MATERIALS

FIGURE 803.9.2(2)
SOLID WALL ~~ASSEMBLIES~~ AND ROOF ASSEMBLIES OF CONCRETE OR OTHER MATERIALS

803.9.3 Masonry unit wall ~~assemblies~~ and roof assemblies. Section of wall ~~assemblies~~ and roof assemblies constructed of masonry units shall be impacted in the center of the section, and at one interface corner or joint as detailed in Figure 803.9.3 (1). Mortared joints shall be impacted directly on the interface joints as detailed in Figure 803.9.3(2).

No more than three impacts shall be made on one *specimen* or specimen panel. Where more than three impacts are required, multiple identical test *specimens* shall be provided.

Exception: More than three impacts shall be permitted to be made on a test *specimen* by mutual consent of test sponsor and *test laboratory*.

FIGURE 803.9.3(1)
MASONRY UNIT WALL ~~ASSEMBLIES~~ AND ROOF ASSEMBLIES

FIGURE 803.9.3(2)
MASONRY UNIT WALL ~~ASSEMBLIES~~ AND ROOF ASSEMBLIES

SECTION 805
PRESSURE TESTING PROCEDURES

805.1 **Pressure testing procedures.** Procedures for pressure testing wall assemblies, roof assemblies, and *impact-protective systems* requiring pressure testing are presented in Sections 805.2 through 805.5, as applicable. *Design wind pressures* used for pressure testing of the *storm shelter envelope* shall be in accordance with Section 304.

805.2 Wall ~~assemblies~~ and roof assemblies. Where testing of wall ~~assemblies~~ and roof assemblies is required, such assemblies shall be pressure tested in the as-supplied condition. Pressure testing of roof assemblies shall be conducted in accordance with FM 4474, ASTM E1592, UL1897 or ASTM E330, whichever is applicable, to a pressure 1.2 times the *design wind pressure* or greater. Pressure testing of wall assemblies shall be conducted in accordance with ASTM E330 to 1.2 times the *design wind pressure* or greater.

		Committee action: Approval as Submitted		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:				

Your comment/reason: In Section 304.6, I'm not sure that the resulting language is clear. Would it be better to state: "… the largest opening protected by an impact protective system on a wall…"

Revise as follows:

304.6 Enclosure classifications. Enclosure classifications for *storm shelters* shall be determined in accordance with ASCE 7,. For determining the enclosure classification for *community storm shelters*, the largest opening protected by an *impact-protective system* on a wall that receives positive external pressure shall be considered as an opening.

IS-STM 08-19-18

ICC 500 Section 202 (new), 306.3.1, 804.9.5, Figures 804.9.5(3) (new) and 804.9.5(4) (new)

Proponent: ICC 500 Committee

Revise as follows:

SECTION 202 DEFINITIONS

ROLLING DOOR. A vertically operating coiling door made of a curtain consisting of 2 inch to 6 inch (51 mm to 152 mm) high formed metal slats interlocking together, supported by a barrel assembly at the top of the opening, and which operates by means of angles acting as door guides at the jambs.

SECTIONAL DOOR. A vertically operating door made of two or more 18 inch to 32 inch (457 to 813 mm) high horizontal sections hinged together and which operates by means of tracks and track rollers at the jambs.

306.3.1 Testing of shelter door assemblies. Door assemblies, including rolling doors and sectional doors, for use in the shelter envelope shall be tested in accordance with missile impact and pressure test procedures described in Chapter 8.

SECTION 804 MISSILE IMPACT TESTING

804.9.5 Doors or other entry/egress systems. All door assemblies and other entry/egress systems shall be impacted within 6 inches (152.4 mm) of an interface hinge joint, within 6 inches (152.4 mm) of an upper latch point and within 6 inches (152.4 mm) of center primary latches or operators as shown in Figure 804.9.5(1).

For rolling door assemblies, the door shall receive two impacts as shown in Figure 804.9.5(3) plus an additional impact on a latching/locking device if provided, plus an additional impact on a barrel assembly if mounted in the door opening.

For sectional door assemblies, the door shall receive three impacts as shown in Figure 804.9.5(4) plus an additional impact on a latching/locking device if provided.

For double door assemblies, a single door leaf shall receive three impacts as shown in Figure 804.9.5(2) plus an additional impact on a center meeting point or mullion.

Where the door contains glazed openings with a size less than or equal to 12 inches (305 mm), an additional sample shall be impacted in the center of the glazed opening. Where glazed openings have a dimension greater than 12 inches (305 mm), the glazed opening shall be treated as a window and tested in accordance with Section 804.9.4 of this standard.

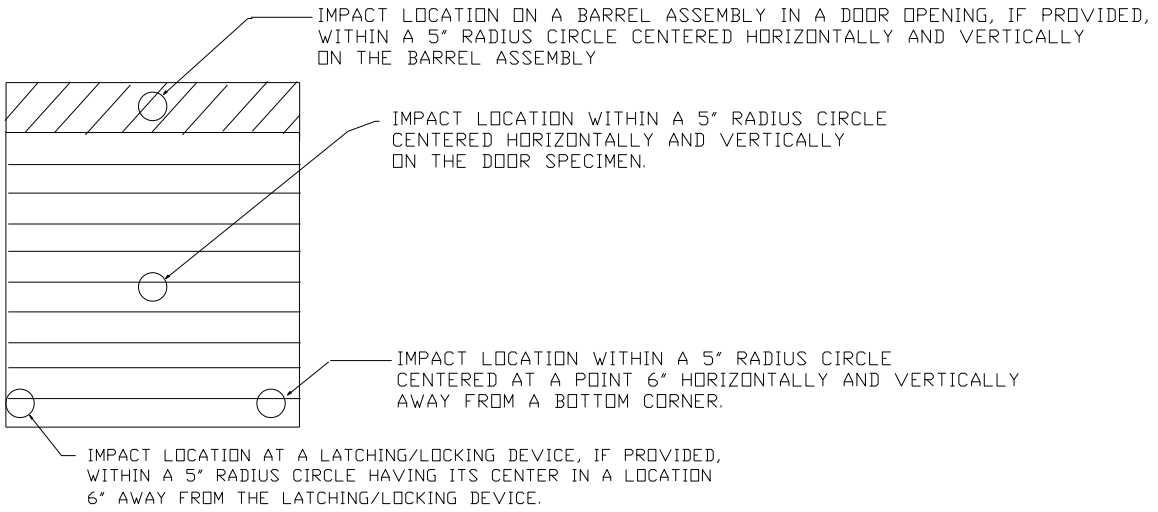


FIGURE 804.9.5(3)
ROLLING DOOR ASSEMBLIES

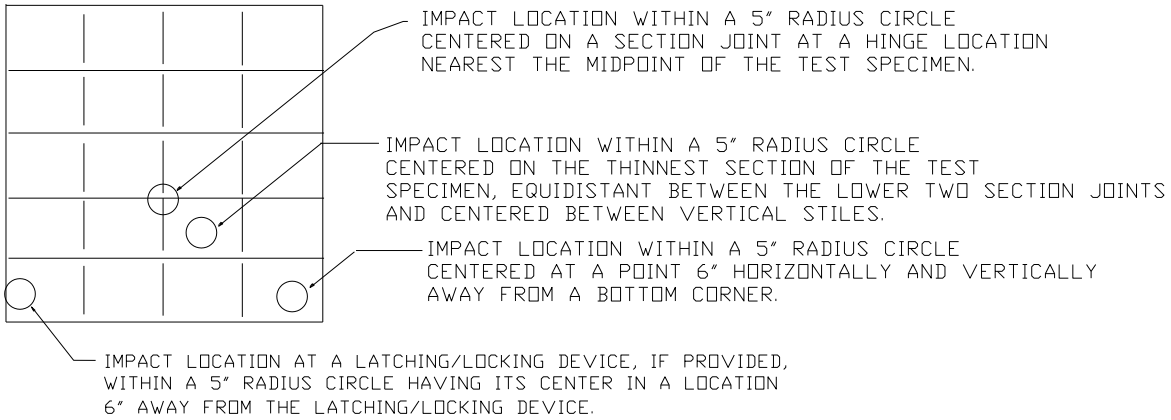


FIGURE 804.9.5(4)
SECTIONAL DOOR ASSEMBLIES

Reason: Clarify application of door impact provisions with respect to testing of rolling and sectional doors

Committee Action: As Modified (8-0)

Replace with the following:

SECTION 202 DEFINITIONS

ROLLING DOOR ASSEMBLY. A vertically operating coiling door made of a curtain consisting of formed metal slats interlocking together, supported by a barrel assembly at the top of the opening, operating by means of angles acting as door guides at the jambs.

SECTIONAL DOOR ASSEMBLY. A vertically operating door made of two or more horizontal sections hinged together, operating by means of tracks and track rollers at the jambs.

306.3.1 Testing of storm shelter door assemblies. Door assemblies, including rolling and sectional door assemblies, for use in the storm shelter envelope shall be tested in accordance with missile impact and pressure test procedures described in Chapter 8.

804.9 Impact locations and the number of impacts. For purposes of testing impact protective systems, impact ~~are to be located~~ locations and quantities shall be as indicated in ~~in the following sections~~ Sections 804.9.1 through 804.9.7.3, as applicable. The tolerance for impact locations shall be within a 2-1/2 inch (64 mm) radius circle, with the center of the circle located as indicated in Sections 804.9.1 through 804.9.7.3 as applicable.

804.9.5 Door assemblies. Door assemblies shall comply with Section 804.9.5.1, 804.9.5.2 or 804.9.5.3 as applicable. Glazed openings in doors shall comply with Section 804.9.5.4.

804.9.5.1 ~~804.9.5 Doors or other entry/egress systems~~ Side-swinging door assemblies. ~~All~~ Side-swinging door assemblies ~~and other entry/egress systems~~ shall be impacted within 6 inches (152.4 mm) of an interface hinge joint, within 6 inches (152.4 mm) of an upper latch point and within 6 inches (152.4 mm) of center primary latches or operators as shown in Figure ~~804.9.5(1)~~ 804.9.5.1(1).

For double door assemblies, a single door leaf shall receive three impacts as shown in Figure ~~804.9.5(2)~~ 804.9.5.1(2) plus an additional impact on a center meeting point or mullion. ~~Where the door contains glazed openings with a size less than or equal to 12 inches (305 mm), an additional sample shall be impacted in the center of the glazed opening. Where glazed openings have a dimension greater than 12 inches (305 mm), the glazed opening shall be treated as a window and tested in accordance with Section 804.9.4 of this standard.~~

FIGURE ~~804.9.5~~ 804.9.5.1 (1)
~~DOORS~~ DOOR ASSEMBLIES ~~AND OTHER ENTRY/EGRESS SYSTEMS~~

FIGURE ~~804.9.5~~ 804.9.5.1 (2)
~~DOORS~~ DOOR ASSEMBLIES ~~AND OTHER ENTRY/EGRESS SYSTEMS~~

804.9.5.2 Rolling door assemblies. For rolling door assemblies, the door shall be impacted at the center of the door, at one bottom corner and within 6 inches (152.4 mm) of primary latches or operators, plus an additional impact centered on a barrel assembly as shown in Figure 804.9.5.2.

Exception: The barrel assembly is not subject to the additional impact where the entire barrel assembly is protected by the shelter envelope.

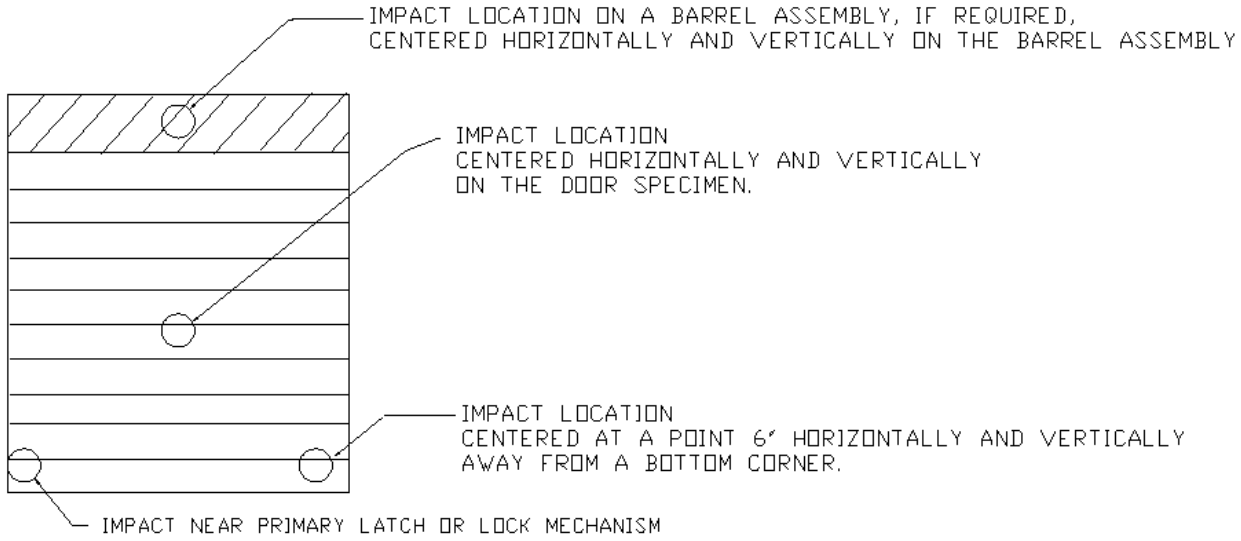


FIGURE 804.9.5.2
ROLLING DOOR ASSEMBLIES

804.9.5.3 Sectional door assemblies. For sectional door assemblies, the door shall be impacted at a sectional joint nearing to the center of the door, within the lower two section joints and centered between two vertical stiles, at one bottom corner, and within 6 inches (152 mm) of the primary latches or operators as shown in Figure 804.9.5.3.

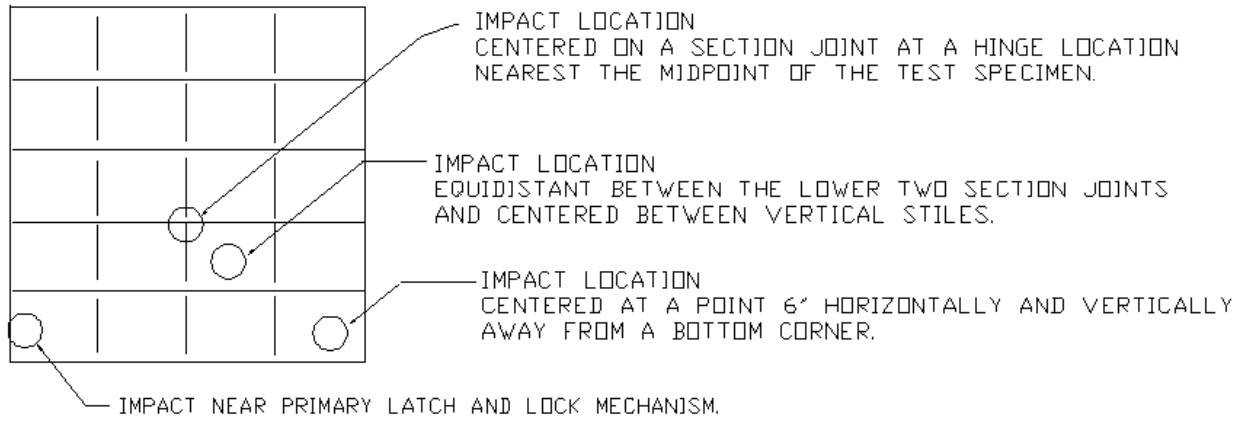


FIGURE 804.9.5.3
SECTIONAL DOOR ASSEMBLIES

804.9.5.4 Glazed openings in doors. Where the door contains glazed openings with a height or width of 12 inches (305 mm) or less, an additional sample shall be impacted in the center of the glazed opening. Where the door contains glazed openings with a height or width greater than 12 inches (305 mm), the glazed opening shall be treated as a window and tested in accordance with Section 804.9.4.

Committee Reason: ICC 500 WG 8 has devoted considerable time to this proposal to explicitly add rolling and sectional door assemblies to ICC 500. The inclusion of rolling and sectional door assemblies has necessitated numerous other changes to the Standard and we believe we have addressed each of those. We do not have the benefit of R&D testing of these assemblies to validate the proposal and as such, the 'As Modified' version represents the best effort and knowledge of the WG.

IS-STM 08-19-18

IS-STM 08-19-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	2
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:		x		

Your comment/reason: Definition of Rolling door Assembly – is the use of 'angles' too specific? Could someone design a system with channels or other shapes, or do that have to use angles? Should we modify the yellow text to something more general like 'tracks' as used in Sectional Door Assembly?

No specific revisions suggested:

ROLLING DOOR ASSEMBLY. A vertically operating coiling door made of a curtain consisting of formed metal slats interlocking together, supported by a barrel assembly at the top of the opening, operating by means of angles acting as door guides at the jambs.

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Hetzel PC		x		

Your comment/reason: Changing "nearing" to "nearest" is a typographical grammatical correction. The other two changes are typographical for consistency with the referenced Figures.

Revise as follows:

803.9.4.2 Rolling door assemblies. For rolling door assemblies, the door shall be impacted at the center of the door, at one bottom corner and within 6 inches (152.4 mm) of a primary latch or lock mechanism ~~latches or operators~~, plus an additional impact centered on a barrel assembly as shown in

Figure 803.9.4.2.
Exception: The barrel assembly is not subject to the additional impact where the entire barrel assembly is protected by the shelter envelope.

803.9.4.3 Sectional door assemblies. For sectional door assemblies, the door shall be impacted at a sectional joint ~~nearest~~ nearing to the center of the door, within the lower two section joints and centered between two vertical stiles, at one bottom corner, and within 6 inches (152 mm) of the primary latch and lock mechanism ~~latches or operators~~ as shown in Figure 803.9.4.3.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Holstein PC		**x**		

Your comment/reason:

a. "And" is necessary in the first clause or else a 5x20 narrow lite would meet the criteria of both the one-impact and two-impact clauses. The prior language indicated that both dimensions must be 12 inches or less to require only a single impact and that if either dimension was greater than 12 inches a second impact was required.

Revise as follows:

803.9.4.4 Glazed openings in doors. Where the door contains glazed openings with a height ~~or~~ and width of 12 inches (305 mm) or less, an additional sample shall be impacted in the center of the glazed opening. Where the door contains glazed openings with a height ~~or~~ and width greater than 12 inches (305 mm), the glazed opening shall be treated as a window and tested in accordance with Section 803.9.5.

b. **Reason:** Editorial. Suggest "a sectional joint near the center of the door" (general) or "the sectional joint nearest to the center of the door." (precise)

Revise as follows:

803.9.4.3 Sectional door assemblies. For sectional door assemblies, the door shall be impacted at a sectional joint near ~~nearing to~~ the center of the door, within the lower two section joints and centered between two vertical stiles, at one bottom corner, and within 6 inches (152 mm) of the primary latches or operators as shown in Figure 803.9.4.3.

IS-STM 08-21-18
ICC 500 Section 804.9.5

Proponent: ICC 500

Revise as follows:

804.9.5 Doors or other entry/egress systems. All door assemblies and other entry/egress systems shall be impacted within 6 inches (152.4 mm) of an interface hinge joint, within 6 inches (152.4 mm) of an upper latch point and within 6 inches (152.4 mm) of center primary latches or operators as shown in Figure 804.9.5(1).

For symmetrical double door assemblies, a single door leaf shall receive three impacts as shown in Figure 804.9.5(2) plus an additional impact on a center meeting point or mullion.

For asymmetrical double door assemblies, a single door leaf shall receive three impacts as shown in Figure 804.9.5(3) and an additional impact on a center meeting point or mullion. The second door leaf shall receive impacts to the primary latch or operator, upper latch point, or interface hinge joint if that component is unique to that door leaf.

Where the door contains glazed openings with a size less than or equal to 12 inches (305 mm) by 12 inches (305 mm), an additional sample shall be impacted in the center of the glazed opening. Where glazed openings have a dimension greater than 12 inches (305 mm), the glazed opening shall be treated as a window and tested in accordance with Section 804.9.4 of this standard.

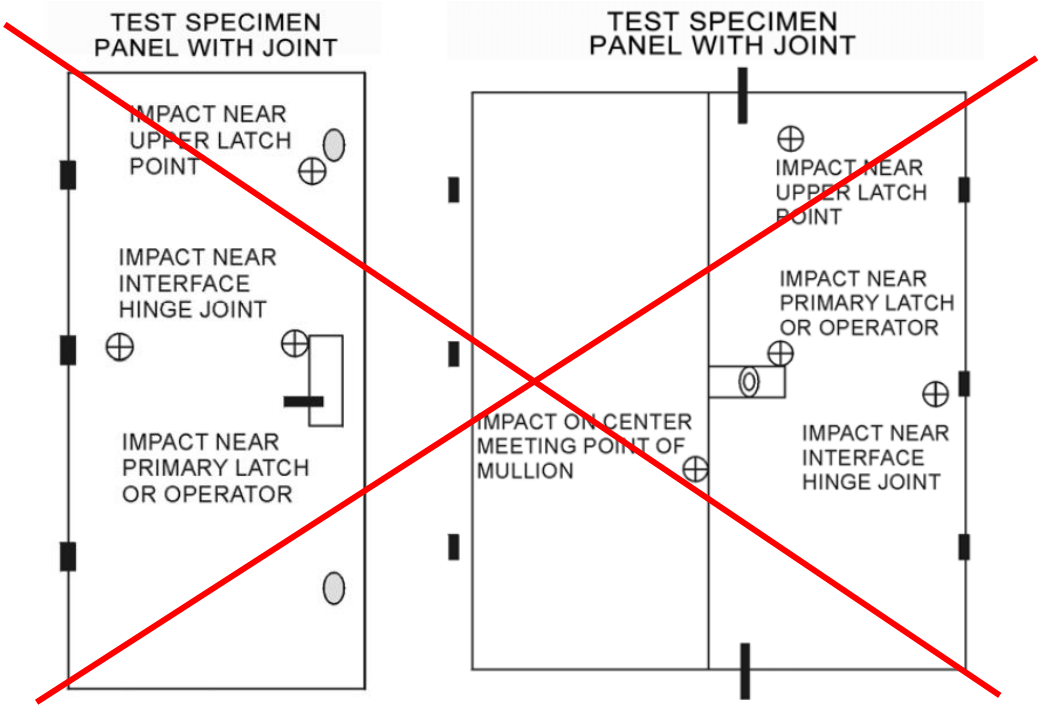


FIGURE 804.9.5(1)
DOORS AND OTHER ENTRY/EGRESS SYSTEMS

FIGURE 804.9.5(2)
DOORS AND OTHER ENTRY/EGRESS SYSTEMS

SINGLE DOOR TEST SPECIMEN

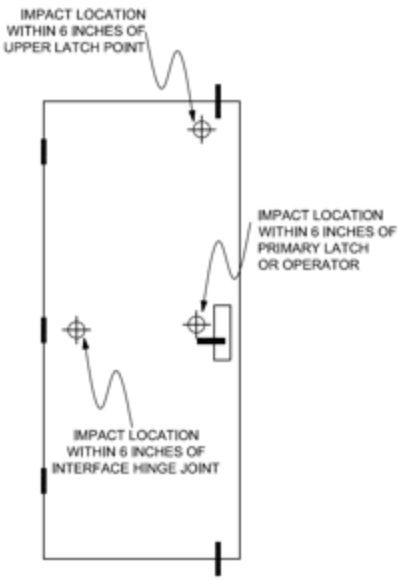


FIGURE 804.9.5(1)
DOORS AND OTHER ENTRY/EGRESS SYSTEMS

SYMMETRICAL DOUBLE DOOR TEST SPECIMEN

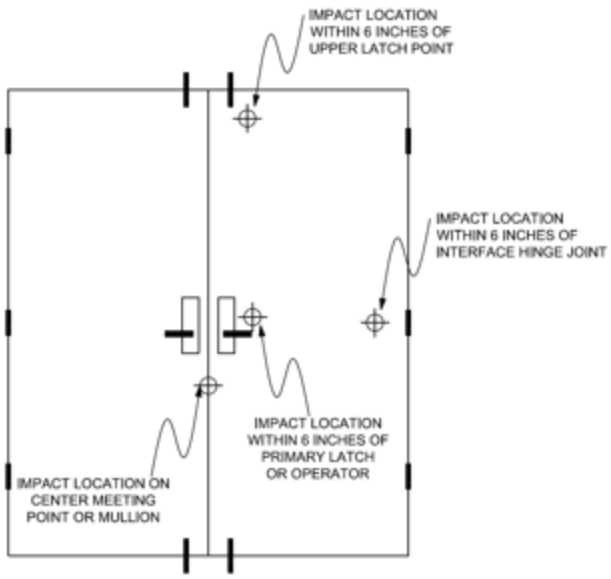


FIGURE 804.9.5(2)
DOORS AND OTHER ENTRY/EGRESS SYSTEMS

ASYMMETRICAL DOUBLE DOOR TEST SPECIMEN

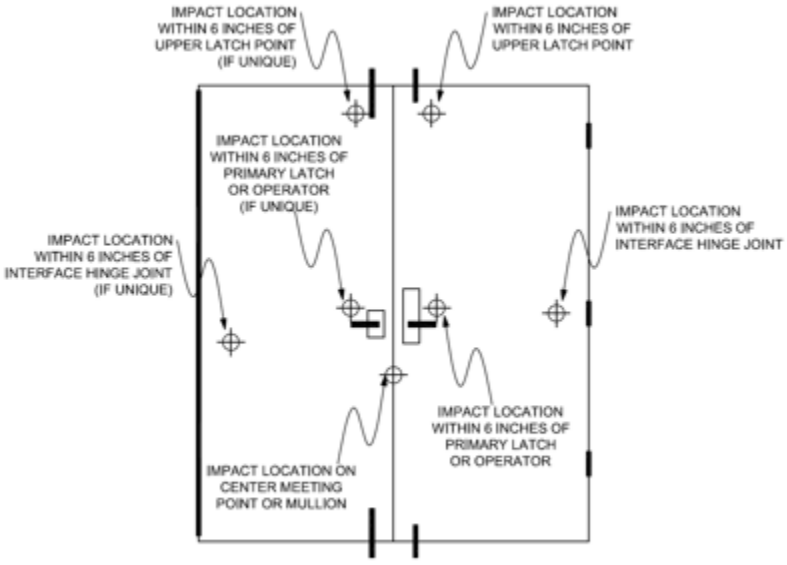


FIGURE 804.9.5(3)
DOORS AND OTHER ENTRY/EGRESS SYSTEMS

Note: Figures 804.9.5.3(1), (2) and (3) are new.

Reason: Figures 804.9.5(1) and 804.9.5(2) are the only impact location figures that use the term "near" in place of the actual locations required by the body text. The proposed figures clarify these locations.

Figure 804.9.5(2) requires an "impact on center meeting point ***OF*** mullion" whereas the text of Section 804.9.5 requires an "impact on a center meeting point ***OR*** mullion". The proposed Figure 804.9.5(2) aligns the figure text with the text of Section 804.9.5.

Figure 804.9.5(2) contains some misaligned elements (left hinges, center impact). The proposed Figure 804.9.5(2) corrects these misalignments.

The figure heading "TEST SPECIMEN" appears to be more applicable to these assemblies than "TEST SPECIMEN PANEL WITH JOINT".

The new figures provide better clarity of the impact locations and also detail the impacts for asymmetrical assemblies. New text clarifies the impacts of asymmetrical assemblies, i.e. pairs with unique attributes on one leaf versus the other.

Committee Action: As Modified (10-0)

Section 804.9.1, 804.9.2, 804.9.3, 804.9.4 – *The exception should be revised* **–**

Exception: More than four impacts may be made on a single specimen with mutual consent of the test sponsor ~~owner~~ and test laboratory.

804.9.5 Doors ~~or other entry/egress systems~~. All door assemblies ~~and other entry/egress systems~~ shall be impacted within 6 inches (152.4 mm) of an interface hinge joint, within 6 inches (152.4 mm) of an upper latch point and within 6 inches (152.4 mm) of center primary latches or operators as shown in Figure 804.9.5(1).

For double door assemblies with each door leaf containing identical hardware, ~~a single~~ one door leaf shall receive the same three impacts as a single door leaf ~~as shown in Figure 804.9.5(2)~~ plus an additional impact on a center meeting point or mullion as shown in Figure 804.9.5(2).

For double door assemblies where one or more hardware components differ between door leaves, each door leaf shall receive the same three impacts as a single door and an additional impact on a center meeting point or mullion as shown in Figure 804.9.5(2). No more than four impacts shall be made on one specimen. Where more than four impacts are required, multiple identical test specimens shall be utilized. Impacts shown in Figure 804.9.5(1) or Figure 804.9.5(2), as applicable, shall occur on the same test specimen.

Exception: More than four impacts shall be permitted to be made on a single specimen with mutual consent of the test sponsor and test laboratory.

Where the door contains glazed openings with a size less than or equal to 12 inches (305 mm) by 12 inches (305 mm), an additional sample shall be impacted in the center of the glazed opening. Where glazed openings have a dimension greater than 12 inches (305 mm), the glazed opening shall be treated as a window and tested in accordance with Section 804.9.4 of this standard.

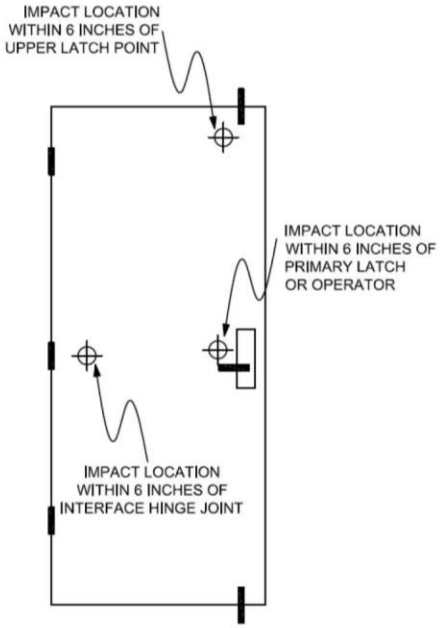
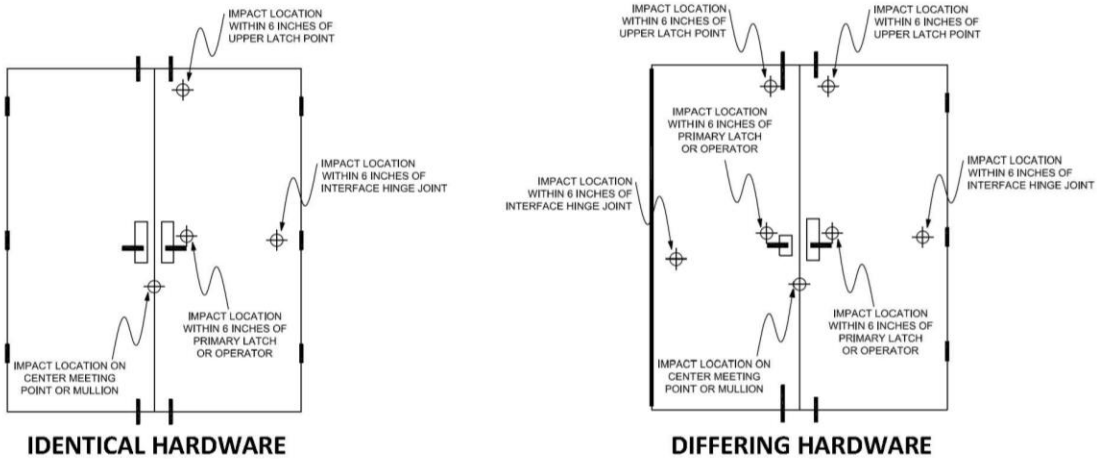


FIGURE 804.9.5(1) – SINGLE DOOR TEST SPECIMEN



IDENTICAL HARDWARE **DIFFERING HARDWARE**

FIGURE 804.9.5(2) – DOUBLE DOOR TEST SPECIMEN

Figure 804.9.5(1) Single door assemblies ~~Doors and other egress/entry systems~~
Figure 804.9.5(2) Double door assemblies ~~Doors and other egress/entry systems~~

Committee Reason: The revised language will coordinate with the other test requirements in this section. The new language will address double doors with different hardware on each door. The figures are revised to coordinate with the test. The exceptions in all 5 sections are coordinated.

IS-STM 08-21-18

IS-STM 08-21-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	15	0	0	0	1
Staff Notes:					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Holstein PC		x		

Your comment/reason: The first reference to double door assemblies (second paragraph) is unnecessary because it duplicates the more detailed descriptions in paragraphs three and four.

Reference to the single door assembly figure [803.9.4.1(1)] in the fourth paragraph is unnecessary because a single door assembly does not take more than four impacts. Clarification is necessary that not all seven impacts from 803.9.4.1(2) must be on the same specimen, just the impacts required for each leaf must be evaluated on the same specimen.

Revise as follows:

803.9.4.1 Side-swinging door assemblies. Side-swinging door assemblies shall be impacted within 6 inches (152.4 mm) of an interface hinge joint, within 6 inches (152.4 mm) of an upper latch point and within 6 inches (152.4 mm) of center primary latches or operators as shown in Figure 803.9.4.1(1).

~~For double door assemblies, a single door leaf shall receive three impacts as shown in Figure 803.9.4.1(2) plus an additional impact on a center meeting point or mullion~~.

For double door assemblies with each door leaf containing identical hardware, one door leaf shall receive the same three impacts as a single door leaf plus an additional impact on a center meeting point or mullion as shown in Figure 803.9.4.1(2).

For double door assemblies where one or more hardware components differ between door leaves, each door leaf shall receive the same three impacts as a single door and an additional impact on a center meeting point or mullion as shown in Figure 803.9.4.1(2). No more than four impacts shall be made on one specimen. Where more than four impacts are required, multiple identical test specimens shall be utilized. Impacts shown <u>on a single leaf</u> in ~~Figure 803.9.4.1(1) or~~ Figure 803.9.4.1(2)~~, as applicable~~, shall occur on the same test specimen.

Exception: More than four impacts shall be permitted to be made on a single specimen with mutual consent of the test sponsor and test laboratory.

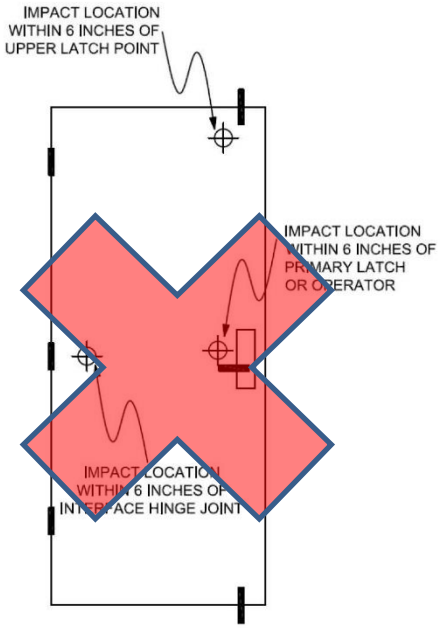
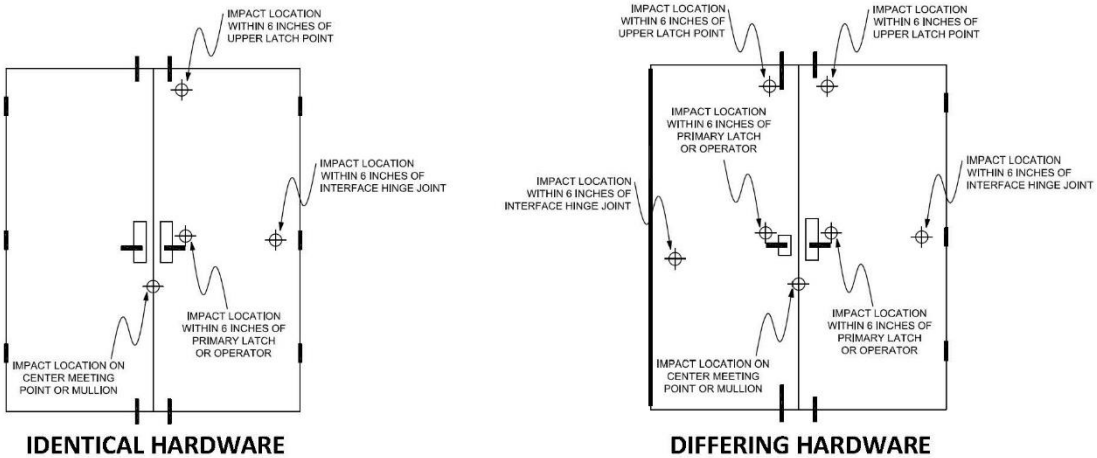


FIGURE 804.9.5(1) – SINGLE DOOR TEST SPECIMEN



IDENTICAL HARDWARE **DIFFERING HARDWARE**

FIGURE 804.9.5(2) – DOUBLE DOOR TEST SPECIMEN

~~**FIGURE** 803.9.4.1(1)~~
~~**SINGLE DOOR ASSEMBLIES**~~

FIGURE 803.9.4.1(2)
DOUBLE DOOR ASSEMBLIES

IS-STM 08-22-18

ICC 500 Section 803.1, 806.3.1.1, 806.3.1.2, 806.3.2.1, 806.3.2.2, 806.4.1, 806.4.2

Proponent: ICC 500

Revise as follows:

803.1 Test assembly. 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 (1219 mm) 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 mm) wide and the full length of the span of the wall section from support to support.

Doors, windows and impact-protective systems are to be tested at the maximum and minimum size listed for use. Operable doors or windows shall be tested for the conditions of swing and latching as specified for use of the product. Impact-protective systems are to be static pressure tested in both directions unless a clear worse-case direction can be determined by the listing agency. 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 wind-borne debris. When it is not practical to install for testing a unit or assembly 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.

806.3.1.1 Door assemblies without glazing for tornado shelters. Door assemblies without glazing for use in tornado shelters shall be static pressure tested ~~away from the door stops~~ to a pressure of at least 1.2 times the pressures specified in Section 304. Pressure tests are permitted to be conducted separately from missile impact tests.

806.3.1.2 Door assemblies without glazing for hurricane shelters. Door assemblies without glazing for use in hurricane shelters shall be static pressure proof tested ~~away from the door stops~~ to a pressure of at least 1.2 times the design wind pressure, subjected to required debris impact tests, and then to cyclic pressure tests following procedures of ASTM E1886. Static pressure tests are permitted to be conducted separately from debris impact tests.

Alternatively, door assemblies without glazing for hurricane shelters shall be statically pressure tested ~~away from the door stops~~ to a pressure of 1.5 times the design wind pressure before impact tests and then to required debris impact tests. Cyclic pressure testing after impact tests is not required for these door assemblies that have been pressure tested to pressures equal to or greater than 1.5 times the design wind pressure.

806.3.2.1 Door assemblies with glazing, sidelights or transoms for tornado shelters. Door assemblies with glazing, sidelights or transoms for tornado shelters shall be static pressure tested ~~away from the door stops~~ following procedures of ASTM E330 to a pressure of at least 1.2 times the pressures specified in Section 304. Pressure tests are permitted to be conducted separately from debris impact tests.

806.3.2.2 Door assemblies with glazing, sidelights or transoms for hurricane shelters. Door assemblies with glazing, sidelights or transoms for hurricane shelters shall be static pressure proof tested ~~away from the door stops~~ to a pressure of at least 1.2 times the design wind pressure. Any required debris impact tests shall follow pressure proof testing. After impact tests the door assembly shall be

subjected to cyclic pressure tests following procedures of ASTM E1886. Static pressure tests are permitted to be conducted separately from debris impact tests.

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 ASTM E330. Pressure tests are allowed to be conducted separately from debris impact tests.

806.4.2 Window assemblies and other glazed openings for hurricane shelters. Window assemblies and other glazed openings for hurricane shelters shall be static pressure tested ~~away from stops~~ to a pressure of at least 1.2 times the design wind pressure. Any required debris impact tests shall follow pressure proof testing. After impact tests the window assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886. Static pressure tests are permitted to be conducted separately from debris impact tests.

806.5.1 Impact-protective systems for tornado shelters. Impact protective systems for tornado shelters 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.

806.5.2 Impact protective systems for hurricane shelters. Impact protective systems for hurricane shelters 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 in accordance with Section 805.5 shall be conducted after debris impact tests. Static pressure tests are permitted to be conducted separately from debris impact tests.

Reason: The term "away from stops" may be vague when evaluating some assemblies (e.g. windows or rolling/sectional doors). Additionally, some assembly designs contain complicated load paths that result in a worse-case test orientation for the assembly as a whole conflicting with the orientation that loads a portion of the assembly (e.g. glazing panel) "away from the stops". Language is suggested for Section 803.1 that would allow a test lab to determine if a worse-case test orientation exists (e.g. side-hinged door away from stops).

The addition of rolling and sectional doors requires the removal of the term 'away from the stops'; clarification and correlation with 803.2 regarding number of test specimens permitted; correlation with IS-STM 08 – 14 – 18 regarding pressure testing of IPS.

Committee Action: As Modified (9-0)

Further modify as follows:

803.1 Test assembly. 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 (1219 mm) 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 mm) wide and the full length of the span of the wall section from support to support.

Doors, windows and impact-protective systems shall ~~are to~~ be tested at the maximum and minimum size listed for use. Operable doors or windows shall be tested for the conditions of swing and latching as specified for use of the product. Impact-protective systems ~~are to~~ shall be static pressure

tested in both directions unless a clear ~~worse~~ worst case direction ~~can be~~ is determined by the ~~listing agency~~ test laboratory. 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 wind-borne debris. When it is not practical to install for testing a unit or assembly 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.

Committee Reason: Agree with reason. Modifications for coordination with change on defining testing laboratory.

IS-STM 08-22-18

		Committee action: Approval as Modified			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**15**	**0**	**0**	**0**	**2**

Staff Notes:

Staff question: The language for the four sections is very inconsistent. "Proof" is used inconsistently. The names of the three tests are inconsistent. There is a lot of duplication of words. In Section 805.3.1.2, 'alternatively' is not good code language. This should be written as an exception or one of two options. In Section 805.5.2, the reference to ASTM E330 is inconsistent with the other sections, and there is no reference to ASTM E1886. Should this reference be consistent? The reference to Section 304 is in Section 805.1. In Section 805.5.2, the phrase ", where the ability to withstand wind-induced pressure is critical to their function," is not needed because it is repeating Section 805.5.

805.3.1.2 Door assemblies without glazing for *hurricane shelters*. Door assemblies without glazing for use in *hurricane shelters* shall be tested for static pressure, followed by any required debris impact tests, followed by cyclic pressure tests. Such assemblies shall be static pressure ~~proof~~ tested to a pressure of 1.2 times the *design wind pressure* or greater in accordance with ASTM E330. ~~, then subjected to required debris impact test, and then to~~ and cyclic pressure ~~tests following procedures of~~ tested in accordance with ASTM E1886.

~~Alternatively,~~ **Exception**: Cyclic pressure testing is not required for door assemblies without glazing for use in *hurricane shelters* ~~shall be statically~~ where such assemblies are static pressure tested to a pressure of 1.5 times the *design wind pressure* or greater in accordance with ASTM E330 ~~before impact tests and then to~~ followed by any required debris impact tests. ~~Cyclic pressure testing after impact tests is not required for these door assemblies that have been pressure tested to pressures equal to 1.5 times the *design wind pressure* or greater~~.

805.3.2.2 Door assemblies with glazing, sidelights or transoms for *hurricane shelters*. Door assemblies with glazing, sidelights or transoms for use in *hurricane shelters* shall be tested for static pressure, followed by any required debris impact tests, followed by cyclic pressure tests. Such assemblies shall be static pressure ~~proof~~ tested to a pressure of 1.2 times the *design wind pressure* or greater in accordance with ASTM E330. ~~Any required debris impact tests shall follow pressure proof testing. After impact tests the door assembly shall be subjected to~~ and cyclic pressure tested in accordance with ~~tests following procedures of~~ ASTM E1886.

805.4.2 Window assemblies and other glazed openings for *hurricane shelters*. Window assemblies and other glazed openings for use in *hurricane shelters* shall be tested for static pressure, followed by any required debris impact tests, followed by cyclic pressure tests. Such assemblies shall be static pressure tested to a pressure of 1.2 times the *design wind pressure* or greater in accordance with ASTM E330. ~~Any required debris impact tests shall follow pressure proof testing. After impact tests the window assembly shall be subjected to~~ cyclic pressure tested in accordance with ~~tests following procedures of~~ ASTM E1886.

805.5.2 Other i*mpact-protective systems* for *hurricane shelters*. Where installed, **o**ther external *impact-protective systems* for use in *hurricane shelters*~~, where the ability to withstand wind-induced pressure is critical to their function, such devices~~ shall be tested for static pressure, followed by any required debris impact tests, followed by cyclic pressure tests. Such assemblies shall be static pressure tested to a pressure of ~~at least~~ 1.2 times the ~~*hurricane shelter*~~ *design wind pressures* ~~specified in Section 304 following the procedures specified in~~ tested in accordance with ASTM E330~~. Cyclic pressure tests conducted in accordance with Section 805.5 shall be conducted after debris impact tests.~~ and cyclic pressure tested in accordance with ASTM E1886.

Staff question: The pointers in 805.3.1 and 805.3.2 are not needed since the qualifiers are repeated in the subsection. The language should be removed from one or the other.

805.3 Door assemblies. Door assemblies shall be pressure tested in the as-supplied condition and, where required, they shall be static pressure tested or cyclically tested as specified in Sections 805.3.1 through ~~805.3.2.2~~ 805.3.4.

~~**805.3.1 Door assemblies without glazing.** Door assemblies without glazing that require testing to meet the qualification of Section 306.3 shall be pressure tested according to procedures specified in Sections 805.3.1.1 and 805.3.1.2.~~

~~**805.3.1.1**~~ **805.3.1 Door assemblies without glazing for *tornado shelters*.** Door assemblies without glazing for use in *tornado shelters* shall be static pressure tested to a pressure of 1.2 times the *design wind pressure* or greater. Pressure tests are permitted to be conducted separately from missile impact tests.

~~**805.3.1.2**~~ **805.3.2 Door assemblies without glazing for *hurricane shelters*.** Door assemblies without glazing for use in *hurricane shelters* shall be static pressure proof tested to a pressure of 1.2 times the *design wind pressure* or greater, then subjected to required debris impact tests, and then to cyclic pressure tests following procedures of ASTM E1886.

Alternatively, door assemblies without glazing for *hurricane shelters* shall be statically pressure tested to a pressure of 1.5 times the *design wind pressure* or greater before impact tests and then to required debris impact tests. Cyclic pressure testing after impact tests is not required for these door assemblies that have been pressure tested to pressures equal to 1.5 times the *design wind pressure* or greater.

~~**805.3.2 Door assemblies with glazing, sidelights or transoms.** Door assemblies with glazing, sidelights or transoms shall be pressure tested according to procedures specified in this section Sections 805.3.2.1 and 805.3.2.2.~~

~~**805.3.2.1**~~ **805.3.3 Door assemblies with glazing, sidelights or transoms for *tornado shelters*.** Door assemblies with glazing, sidelights or transoms for *tornado shelters* shall be static pressure tested following procedures of ASTM E330 to a pressure of 1.2 times the *design wind pressure* or greater. Pressure tests are permitted to be conducted separately from debris impact tests.

~~**805.3.2.2**~~ **805.3.4 Door assemblies with glazing, sidelights or transoms for *hurricane shelters*.** Door assemblies with glazing, sidelights or transoms for *hurricane shelters* shall be static pressure proof tested to a pressure of 1.2 times the *design wind pressure* or greater. Any required debris impact tests shall follow pressure proof testing. After impact tests the door assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886.

Staff question: Consistency for tornado shelters.

805.3.1.1 Door assemblies without glazing for *tornado shelters*. Door assemblies without

glazing for use in *tornado shelters* shall be static pressure tested to a pressure of 1.2 times the *design wind pressure* or greater in accordance with ASTM E330. Pressure tests are permitted to be conducted separately from missile impact tests.

805.3.2.1 Door assemblies with glazing, sidelights or transoms for *tornado shelters*. Door assemblies with glazing, sidelights or transoms for *tornado shelters* shall be static pressure tested ~~following procedures of ASTM E330~~ to a pressure of 1.2 times the *design wind pressure* or greater in accordance with ASTM E330. Pressure tests are permitted to be conducted separately from debris impact tests.

805.4.1 Window assemblies and other glazed openings for *tornado shelters*. Window assemblies and other glazed openings for *tornado shelters* shall be static pressure tested to a pressure of 1.2 times the *design wind pressure* or greater ~~following procedures detailed in~~ in accordance with ASTM E330. Pressure tests are allowed to be conducted separately from debris impact tests.

805.5.1 Other *Impact-protective systems* for *tornado shelters*. Where installed, other **e**xternal *impact-protective systems* for *tornado shelters*, ~~where the ability to withstand wind-induced pressure is critical to their function, such systems~~ shall be static pressure tested ~~following procedures specified in ASTM E330~~ to a pressure of 1.2 times the *design wind pressures* or greater in accordance with ASTM E330. Debris impact tests and pressure tests are permitted to be conducted separately.

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

If the language is coordinated, it could be stated just once in Section 805.3 and delete all the door sections following:

If the language is coordinated, it could be stated just once in Section 805.3 and delete 805.3.1 through 805.5.2 sections following:

805.3 Door and window assemblies and other impact-protective systems. Door and window assemblies and other impact protective systems shall be pressure tested in the as-supplied condition and, where required, they shall be static pressure tested or cyclically tested as specified in the 805.3.1 ~~through 805.3.2.2~~ or 805.3.2.

805.3.1 Hurricane shelters. Door and window assemblies and other impact protective systems for use in *hurricane shelters* shall be tested for static pressure, followed by any required debris impact tests, followed by cyclic pressure tests. Such assemblies shall be static pressure tested to a pressure of 1.2 times the *design wind pressure* or greater in accordance with ASTM E330. and cyclic pressure ~~of~~ tested in accordance with ASTM E1886.

Exception: Cyclic pressure testing is not required for door assemblies without glazing for use in *hurricane shelters* where such assemblies are static pressure tested to a pressure of 1.5 times the *design wind pressure* or greater in accordance with ASTM E330 followed by any required debris impact tests.

805.3.2 Tornado shelters. Door and window assemblies and other impact protective systems for use in *tornado shelters* shall be tested for static pressure, to a pressure of 1.2 times the *design wind pressure* or greater in accordance with ASTM E330. Debris impact tests and pressure tests are permitted to be conducted separately.

Staff Question: IS-STM 08-22-17 removed ‘away from stop’ from the door the window and door provisions. Shout the exception be deleted from 805.5.1.

805.5.1 Other *Impact-protective systems* for *tornado shelters*. Where installed, other **e**xternal

impact-protective systems for *tornado shelters*, where the ability to withstand wind-induced pressure is critical to their function, such systems shall be static pressure tested following procedures specified in ASTM E330 to a pressure of 1.2 times the *design wind pressures* or greater. Debris impact tests and pressure tests are permitted to be conducted separately.

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

Staff question: It is not clear what testing is required for alcove or baffled entry systems.

805.5 *Alcove or baffled storm shelter entry systems*. Any element of the *alcove or baffled storm shelter entry system* with the ability to resist wind-induced pressure that is critical to the function of the *alcove or baffled storm shelter entry system* shall be designed to meet the requirements of Section 304 or shall be pressure tested in accordance with Section 805.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC				

Your comment/reason: It has been stated within the standard (Section 802.2), and expressed within commentary, that Static Pressure tests are permitted to be conducted on a separate specimen from missile impact/cyclic test specimen. New Section 804.3 ensures that cycling be done on the same test specimen that received impacts. Also using language from new Section 802.5 for separate test specimen.

Revise as follows:

805.3.1.2 Door assemblies without glazing for *hurricane shelters*. Door assemblies without glazing for use in *hurricane shelters* shall be static pressure proof tested to a pressure of 1.2 times the *design wind pressure* or greater, then subjected to required debris impact tests, and then to cyclic pressure tests following procedures of ASTM E1886. Testing on a separate specimen for static pressure shall be permitted.

Alternatively, door assemblies without glazing for *hurricane shelters* shall be statically pressure tested to a pressure of 1.5 times the *design wind pressure* or greater before impact tests and then to required debris impact tests. Cyclic pressure testing after impact tests is not required for these door assemblies that have been pressure tested to pressures equal to 1.5 times the *design wind pressure* or greater.

805.3.2.2 Door assemblies with glazing, sidelights or transoms for *hurricane shelters*. Door assemblies with glazing, sidelights or transoms for *hurricane shelters* shall be static pressure proof tested to a pressure of 1.2 times the *design wind pressure* or greater. Any required debris impact tests shall follow pressure proof testing. After impact tests the door assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886. Testing on a separate specimen for static pressure shall be permitted.

805.4.2 Window assemblies and other glazed openings for *hurricane shelters*. Window assemblies and other glazed openings for *hurricane shelters* shall be static pressure tested to a pressure of 1.2 times the *design wind pressure* or greater. Any required debris impact tests shall follow pressure proof testing. After impact tests the window assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886. Testing on a separate specimen for static pressure shall be permitted.

805.5.2 Other *impact-protective systems* for *hurricane shelters*. Where installed, other external *impact-protective systems* for *hurricane shelters*, where the ability to withstand wind-induced pressure is critical to their function, such devices shall be static pressure tested to a pressure of at least 1.2 times

the *hurricane shelter design wind pressures* specified in Section 304 following the procedures specified in ASTM E330. Cyclic pressure tests conducted in accordance with Section 805.5 shall be conducted after debris impact tests. Testing on a separate specimen for static pressure shall be permitted.

Staff question: Should this language be coordinated/consisted with the sentence in 805.3.1, 805.3.2.1, 805.4.1, 805.5.1 – "Pressure test are permitted to be conducted separately from missile impact test." Is this also separate specimens?

Also, is this addressed in Section 802.2 and should be removed from all sections?

802.2 Number of test *specimens*. Where both pressure and impact tests are required, testing of a single *specimen* subjected separately to each effect or two *specimens*, one subject to each load effect, shall be permitted.

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Holstein PC		**x**		

Your comment/reason: As written, this section conflicts with Section 802.2, which allows pressure and impact testing to be conducted on separate samples. Cyclic pressure loading must be conducted on the same sample as impact, but static pressure loading should be allowed to be tested on a separate sample.

Revise as follows:

805.3.1.2 Door assemblies without glazing for *hurricane shelters*. Door assemblies without glazing for use in *hurricane shelters* shall be static pressure proof tested to a pressure of 1.2 times the *design wind pressure* or greater. ~~, then~~ The assemblies subjected to required debris impact tests~~, and then~~ shall then be subjected to cyclic pressure tests following procedures of ASTM E1886.

Alternatively, door assemblies without glazing for *hurricane shelters* shall be statically pressure tested to a pressure of 1.5 times the *design wind pressure* or greater ~~before impact tests and then to required debris impact tests~~. Cyclic pressure testing after impact tests is not required for these door assemblies that have been pressure tested to pressures equal to 1.5 times the *design wind pressure* or greater.

805.3.2.2 Door assemblies with glazing, sidelights or transoms for *hurricane shelters*. Door assemblies with glazing, sidelights or transoms for *hurricane shelters* shall be static pressure proof tested to a pressure of 1.2 times the *design wind pressure* or greater. ~~Any required debris impact tests shall follow pressure proof testing.~~ After impact tests the door assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886.

805.4.2 Window assemblies and other glazed openings for *hurricane shelters*. Window assemblies and other glazed openings for *hurricane shelters* shall be static pressure tested to a pressure of 1.2 times the *design wind pressure* or greater. ~~Any required debris impact tests shall follow pressure proof testing.~~ After impact tests the window assembly shall be subjected to cyclic pressure tests following procedures of ASTM E1886.

Your comment/reason: The term "away from the stop" is vague when evaluating some assemblies

that may have more than one stop. Additionally, some assembly designs contain complicated load paths that result in a worst-case test orientation for the entire assembly that conflicts with the orientation that loads a single component "away from the stop". The proposed language would allow determinations to be made specific to the assembly under evaluation. This is an extension of the reason behind IS-STM 08-22-18, which was accepted As Modified.

Revise as follows:

805.5.1 Other *Impact-protective systems* for *tornado shelters*. Where installed, other **e**xternal *impact-protective systems* for *tornado shelters*, where the ability to withstand wind-induced pressure is critical to their function, such systems shall be static pressure tested following procedures specified in ASTM E330 to a pressure of 1.2 times the *design wind pressures* or greater. Debris impact tests and pressure tests are permitted to be conducted separately.

Exception: *Impact-protective systems* ~~with a jamb or stop~~ determined by the test laboratory to have a clear worst-case direction need only to be tested with pressure ~~only away from the stop~~ acting in this direction.

IS-STM 08-23-18
ICC 500 Sections 101.2, 803.1, 804.9.2, 804.9.3, 804.9.4

Proponent: ICC 500

Revise as follows:

803.1 Test assembly. 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 assemblies, roof assemblies, ~~door or window assemblies~~ or other impact protective systems shall be allowed in lieu of testing entire shelters. Where failure of framing members controls the impact performance, wall and roof ~~sections~~ assemblies subjected to debris impact ~~pressure testing and wall sections where impact resistance may be controlled by framing members~~ shall be a minimum of 4 feet (1219 mm) wide and the full length of the span of the wall or roof section from support to support. ~~Except~~ Where failure of framing members ~~may~~ has been shown through testing to not control the impact performance, wall and roof sections subjected to debris impact testing shall be a minimum of 4 feet (1219 mm) wide by 4 feet (1219 mm) high unless dimensions of the actual assembly are less than these dimensions.

Doors, windows and impact-protective systems are to be tested at the maximum and minimum size listed 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 wind-borne 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.

Reason: This proposal was originally part of IS-STM 10-01-18 8. Section 803.1 were sent to Work group 8 for further review.

For Section 803.1, the words "may" has a dual meaning as both "can" and "might." This term is subjective and should not be used in code language.

The WG felt that wall and roof sections subject to testing should be tested at the maximum and minimum sizes, as impact protective systems are. This change does not remove the options for wall and roof sections to be designed. The WG also believed that the existing language 'except where failure of framing members may control impact performance' is an indeterminate criteria.

The first paragraph will reorder the 2nd and 3rd sentence.

For the committee's information, the 2nd paragraph has been approved to be reworded as follows.

> ~~Doors, windows and~~ *Impact-protective systems* ~~are to~~ shall be impact tested and cyclic tested where applicable, ~~tested~~ at the maximum and minimum size listed for use. Static pressure testing shall be conducted on the maximum size listed for use. Operable ~~doors or windows~~ door assemblies and window assemblies shall be tested for the conditions of swing and latching including inward or outward swing separately as specified for use of the product. Impact-protective systems shall be static pressure tested in both directions unless a clear worst-case

direction is determined by the *test laboratory*. Paired doors and their latching hardware shall be tested independently from single doors. The *specimen* shall consist of the entire assembled unit and shall, ~~when~~ where practical, be mounted as it will be installed in a *storm shelter*, and shall contain all devices used to resist wind forces and wind-borne debris. ~~When~~ Where it is not practical to install for testing ~~a doors or windows~~ door assemblies and window assemblies as it will be mounted in a *storm shelter*, then the unit or assembly shall be mounted in a test buck to connect the *specimen* to the test ~~frame/stand/chamber~~ frame, stand or *test chamber*. Details of the mounting shall be described in the test report.

Committee Action: As Submitted (10-0)

Committee Reason: See reason.

IS-STM 08-23-18

IS-STM 08-23-18		Committee action: As Submitted			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	14	1	0	0	0
Staff Notes:					

		Committee action: Approval as Submitted		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Levitan Vote:		x		

Your comment/reason: In 802.1, the second sentence implies a different definition for impact protective system than we have in chapter 2. The use of the word 'other' as highlighted in yellow implies that wall and roof assemblies are also impact protective systems, which does not seem to be the case as defined in chapter 2. The fix could be as simple as deleting the word 'other', or more complex if there really is a discrepancy between understanding of the term impact protective systems

Revise as follows:

802.1 Test assembly. 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 assemblies, roof assemblies, or ~~other~~ impact protective systems shall be allowed in lieu of testing entire *storm shelters*. Where failure of framing members controls the impact performance, wall and roof assemblies subjected to debris impact-testing-shall be a minimum of 4 feet (1219 mm) wide and the full length of the span of the wall or roof section from support to support. Where failure of framing members ~~may~~ has been shown through testing to not control the impact performance, wall and roof sections subjected to debris impact testing shall be a minimum of 4 feet (1219 mm) wide by 4 feet (1219 mm) high unless dimensions of the actual assembly are less than these dimensions.

Impact-protective systems shall be impact tested and cyclic tested where applicable, at the maximum and minimum size listed for use. Static pressure testing shall be conducted on the maximum size listed for use. Operable door assemblies and window assemblies shall be tested for the conditions of swing and latching including inward or outward swing separately as specified for use of the product. Impact-protective systems shall be static pressure tested in both directions unless a clear worst-case direction is

determined by the *test laboratory*. Paired doors and their latching hardware shall be tested independently from single doors. The *specimen* shall consist of the entire assembled unit and shall, where practical, be mounted as it will be installed in a *storm shelter*, and shall contain all devices used to resist wind forces and wind-borne debris. Where it is not practical to install for testing door assemblies and window assemblies as it will be mounted in a *storm shelter*, then the unit or assembly shall be mounted in a test buck to connect the *specimen* to the test frame, stand or *test chamber*. Details of the mounting shall be described in the test report.

Chapter 9
REFERENCED STANDARDS

IS-STM 09-01-18
ICC 500 Section Chapter 9

Proponent: Marc Levitan, representing ICC 500 Committee

Revise as follows:

ASCE
7—~~10~~ 16 Minimum Design Loads for Buildings and Other Structures ~~with Supplement No. 1~~
24—~~05~~ 14 Flood Resistant Design and Construction

ASTM
C920—~~08~~ 14a Standard Specification for Elastomeric Joint Sealants
E330/E330M—~~02~~ 14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
E631—06 Terminology of Building Constructions
E1886—~~05~~ 13A Standard Test Method for the Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
E1996—~~12~~ 14a Specification for Performance of Exterior Windows, Curtains Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricane

DOC
PS 20—10 American Softwood Lumber Standard

ICC
IBC—~~15~~ 21 International Building Code
ICC A117.1—~~09~~ 17 Accessible and Usable Buildings and Facilities

TMS
602—~~2011~~ 2016 Specification for Masonry Structures

Reason: Automatic update of standards

Staff note: There is an errata for the inclusion of ASTM C920 and TMS 602 (referenced in Section 306.8 Exception 2.

Committee Action: Approve as modified (12-0)

Further modify as follows:

E631—~~06~~ 15 Terminology of Building Constructions

Committee Reason: Updates to latest dates. Up date E631
11-8-2018: Work Groups should check new editions of standards to make sure revisions have not resulted in incorrect references, or their have been significant revisions that should addressed.

IS-STM 09-01-18

IS-STM 09-01-18		Committee action: Approval as Modified			
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason	Public Comment
Report	**13**	**2**	**0**	**0**	**0**
Staff Notes: errata					

		Committee action: Approval as Modified		
	Affirmative	Affirmative with comment	Negative with comment	Abstain with reason
Ehrlich Vote:		x		

Your comment/reason: I checked the referenced standards and found five with newer editions than currently listed. The latest edition of ASCE 24 is 2014, not 2015. Finally, delete the reference to ASTM E631 as the associated section was deleted by proposal 08-16-18:

Revise as follows:

ASCE:

24—14~~15~~ Flood Resistant Design and Construction

ASTM:

C920—18~~14a~~ Standard Specification for Elastomeric Joint Sealants

~~E631—06 Terminology of Building Constructions~~

E1886—19~~13A~~ Standard Test Method for the Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials

E1996—17~~14a~~ Specification for Performance of Exterior Windows, Curtains Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

DOC:

PS 20—15~~10~~ American Softwood Lumber Standard

NFPA:

NFPA-18~~13~~ Portable Fire Extinguishers

(Note revisions for the 2020 edition of PS 20 were just approved on 11/15/19 by the American Lumber Standard Committee. The new edition may be available in time to further update ICC 500.)

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Manley Vote:		**x**		

Your comment/reason: In the Clean Draft, check the edition year for ASCE 24; it's listed as 2015. But the publication is really 2014.

Revise as follows:

ASCE:

24—14~~15~~ Flood Resistant Design and Construction

Multi-chapter proposals

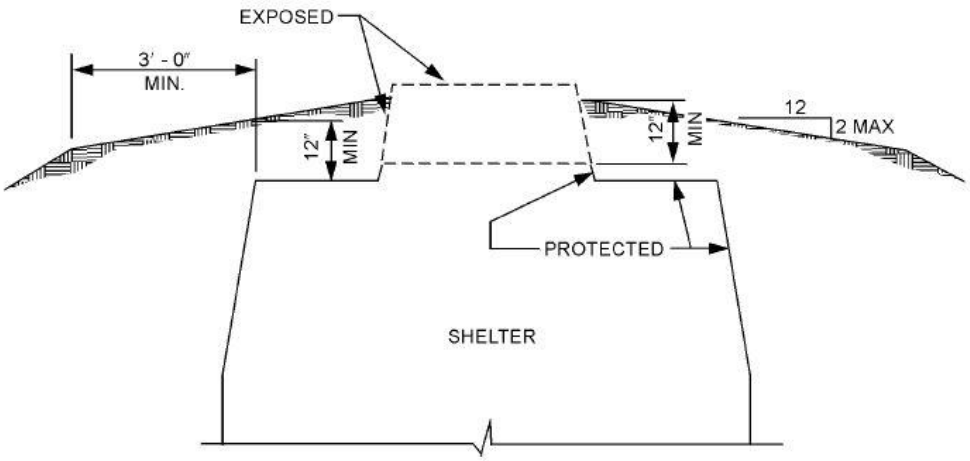
IS-STM 10-07-18
ICC 500 Sections 305.2.2, 804.9.7, 804.9.7.1, 804.9.7.2, 804.9.7.3

Proponent: Crystal Wespestad, representing self

Revise as follows:

305.2.2 Soil-covered portions of shelters. Portions of soil-covered shelters, with less than 12 inches (304.8 mm) of soil cover protecting shelter horizontal surfaces, or with less than 36 inches (914.4 mm) of soil cover protecting shelter vertical surfaces, shall be tested for resistance to missile perforation as though the surfaces were exposed. To qualify for shielding from soil cover, the soil surfaces shall slope away from the entrance walls or other near grade enclosure surfaces of underground shelters at a slope of not more than 2 inches per foot for a horizontal distance of not less than 3 feet (914 mm) from the exposed portions of the shelter or unexposed portions deemed to be protected by soil cover~~. See~~ as detailed in Figure 305.2.2.

STRUCTURAL DESIGN CRITERI



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 305.2.2
UNDERGROUND SHELTER

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~~.~~ and as shown in 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 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 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 804.9.7.2. ~~Examples of this type of system are shown in Figures 804.9.7.1 and 804.9.7.2.~~
3. Storm debris impact on an entry door is limited to an angle less than 90 degrees (1.57 rad) by impact protective systems. The debris test requirements for this type of system are presented in Section 804.9.7.3. ~~Examples of this type of system are shown in Figure 804.9.7.3.~~

804.9.7.1 Alcove/baffled entry systems for which no testing is required. Shelter entrances, whether provided with a door or not, that are protected by an alcove or baffled entry system that require missiles to impact at least two surfaces meeting the requirements of Section 306.2 prior to arriving at the protected occupant area shall not be required to undergo debris impact testing~~. See~~ as detailed in Figure 804.9.7.1. When a solid door is installed as a closure for this type of entry system, the door need not meet the wind load requirements of Section 304.

804.9.7.2 Door subject to rebound impact. Where the alcove or baffled entry system prevents a first impact of the design missile on the door but the door is subject to a rebounded impact of the design missile after it has impacted one surface meeting the requirements of Section 306.2 possible ~~(see~~ as detailed in Figure 804.9.7.2~~)~~, then a door assembly shall meet the wind load requirements of Section 304 and the debris impact requirements of Section 305 except that the missile shall be, at a minimum, a 9-pound sawn lumber 2 by 4 traveling at 50 feet per second (15.2 m/s). Entry systems having doors that are protected from the initial and first rebounded impacts of debris shall comply with the requirements of Section 804.9.7.1.

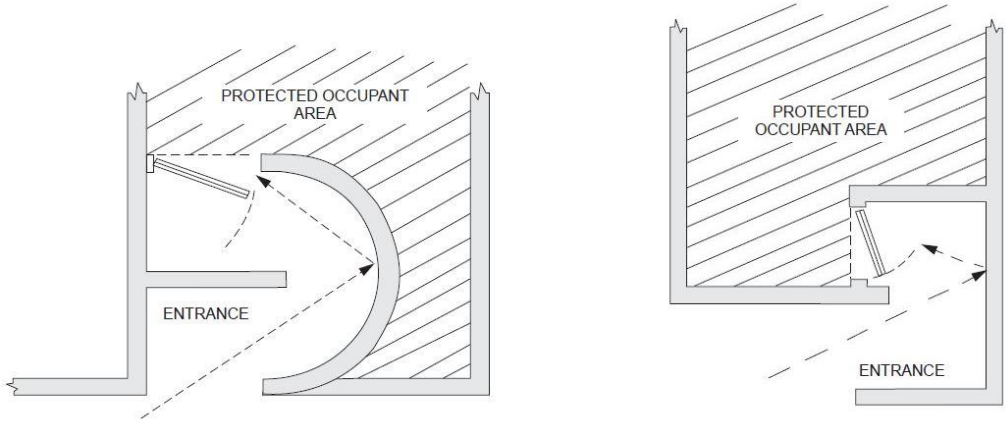


FIGURE 804.9.7.2
DOORS SUBJECT TO REBOUND IMPACT

804.9.7.3 Door subject to first impact. If a first-strike angle missile impact on the door is possible ~~(see~~ as detailed in Figure 804.9.7.3~~)~~, then the door is deemed suitable if the door assembly meets the wind load requirements of Section 304 and the door assembly meets one of the following debris impact criteria:

1. The door withstands the impact of a missile specified in Section 305 striking the door assembly at an angle closest to perpendicular to the plane of the door that the missile might strike in the shelter application; or
2. The door assembly is tested following procedures specified in Section 305 or a door assembly is selected that has withstood missile impacts by the design missile striking perpendicular to the surface with speed equal to or greater than the shelter design missile's velocity component perpendicular to the door assembly for the most critical angle that can occur in the application.

The minimum debris impact criterion for the door shall be an impact perpendicular to the door of a 9-pound sawn lumber 2 by 4 traveling at 50 feet per second [34 mph (15.2 m/s)].

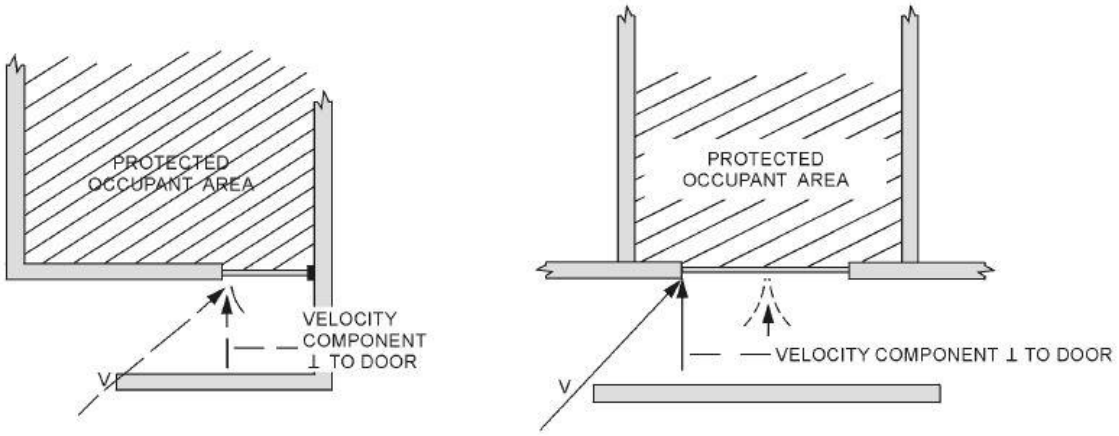


FIGURE 804.9.7.3
DOORS SUBJECT TO FIRST IMPACT

Reason: The way figures are referenced is not consistent and does not make the figure part of the requirement. Using "as detailed in" of "as shown in" would be consistent with the figure references of impact location in 804.9. In Items 1, 2 and 3 of Section 804.9.7, "Examples of this type of system are shown in Figure…." is not needed. As written it is editorials information, not a requirement; and the figures are referenced in each of the referenced sections.

Committee Action: As Modified (6-0 meeting) (11-1 electronic vote)

Replace with the following:

103.2 Figures. Unless specifically stated, figures included herein are provided for informational purposes only and are not considered part of the standard.

.

305.2.2 Soil-covered portions of shelters. Portions of soil-covered shelters, with less than 12 inches (304.8 mm) of soil cover protecting shelter horizontal surfaces, or with less than 36 inches (914.4 mm) of soil cover protecting shelter vertical surfaces, shall be tested for resistance to missile perforation as though the surfaces were exposed. To qualify for shielding from soil cover, the soil surfaces shall slope away from the entrance walls or other near grade enclosure surfaces of underground shelters at a slope of not more than 2 inches per foot for a horizontal distance of not less than 3 feet (914 mm) from the exposed portions of the shelter or unexposed portions deemed to be protected by soil cover. See Figure 305.2.2 for an example.

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. See Figure 804.9.7 ~~illustrates~~ for an example of an alcove~~/~~ or baffle shelter entry system. Debris impact test requirements are presented for systems for which:

1. Storm debris impacts at least two impact-protective systems 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 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 804.9.7.2. Examples of this type of system are shown in Figures 804.9.7.1 and 804.9.7.2.
3. Storm debris impact on an entry door is limited to an angle less than 90 degrees (1.57 rad) by impact protective systems. The debris test requirements for this type of system are presented in Section 804.9.7.3. Examples of this type of system are shown in Figure 804.9.7.3.

804.9.7.1 Alcove/baffled entry systems for which no testing is required. Shelter entrances, whether provided with a door or not, that are protected by an alcove or baffled entry system that require missiles to impact at least two surfaces meeting the requirements of Section 306.2 prior to arriving at the protected occupant area shall not be required to undergo debris impact testing. See Figure 804.9.7.1 for an example. When a solid door is installed as a closure for this type of entry system, the door need not meet the wind load requirements of Section 304.

804.9.7.2 Door subject to rebound impact. Where the alcove or baffled entry system prevents a first impact of the design missile on the door but the door is subject to a rebounded impact of the design missile after it has impacted one surface meeting the requirements of Section 306.2 possible (see Figure 804.9.7.2 for an example), then a door assembly shall meet the wind load requirements of Section 304 and the debris impact requirements of Section 305 except that the missile shall be, at a minimum, a 9-pound sawn lumber 2 by 4 traveling at 50 feet per second (15.2 m/s). Entry systems having doors that are protected from the initial and first rebounded impacts of debris shall comply with the requirements of Section 804.9.7.1.

804.9.7.3 Door subject to first impact. If a first-strike angle missile impact on the door is possible (see Figure 804.9.7.3 for an example) then the door is deemed suitable if the door assembly meets the wind load requirements of Section 304 and the door assembly meets one of the following debris impact criteria:

1. The door withstands the impact of a missile specified in Section 305 striking the door assembly at an angle closest to perpendicular to the plane of the door that the missile might strike in the shelter application; or
2. The door assembly is tested following procedures specified in Section 305 or a door assembly is selected that has withstood missile impacts by the design missile striking perpendicular to the surface with speed equal to or greater than the shelter design missile's velocity component perpendicular to the door assembly for the most critical angle that can occur in the application.

The minimum debris impact criterion for the door shall be an impact perpendicular to the door of a 9-pound sawn lumber 2 by 4 traveling at 50 feet per second [34 mph (15.2 m/s)].

Committee Reason: The work group understood the legal reason for not making figures perceived as mandatory when they are for examples to clarify the requirements. The addition of 103.2 should allow for figures to be provided for illustration. This was copied from ICC A117.1.

However, the work group did not want to move the figures to commentary, or loose the information that let you know a figure was provided. That is the reason for "for an example"

The reference to Figure 502.3.2 was already addressed in IS-STM 05-08-18.

IS-STM 10-07-18

IS-STM 10-07-18		**Committee action: Approval as Modified**			
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**	**Public Comment**
Report	**15**	**0**	**0**	**0**	**1**
Staff Notes: Assigned to work group 1.					

		Committee action: Approval as Modified		
	Affirmative	**Affirmative with comment**	**Negative with comment**	**Abstain with reason**
Dain PC:		**x**		

Your comment/reason:

Question – do we have any that specifically state as such? Without this text I would add that any figures in the commentary only should be labeled "Commentary Figure 304.9" so it's clear these figures are not part of the standard.

No revisions suggested:

103.2 Figures. Unless specifically stated, figures included herein are provided for informational purposes only and are not considered part of the standard.

Errata:

The following is errata identified in the "ICC 500 clean draft for ballot" that was provided with the original ballot in Sept. 2019. The errata is included and highlighted in the "ICC 500 clan draft for ballot with errata" that will be provided with the committee vote and public comments.

101.2 Scope. This standard applies to the design, construction, installation and inspection of *storm shelters* constructed for the purpose of providing protection from ~~high winds associated with~~ tornadoes and hurricanes. *Storm shelters* ~~may~~ shall be constructed as either separate~~,~~ detached buildings or rooms or spaces ~~and areas~~ within new or existing buildings. *Storm shelters* designed and constructed to this standard shall be designated as *hurricane shelters*, *tornado shelters* or combined hurricane and *tornado shelters*. Design of facilities for use as emergency shelters after the storm is outside the scope of this standard.

~~**107.1**~~ **106.1 General.** ~~Where required by the authority having jurisdiction,~~ For all *storm shelters*, ~~construction~~ submittal documents shall be prepared and submitted to the *authority having jurisdiction* with each permit application. Such documents shall contain information as required by the *applicable* ~~building~~ *code* and this section. Storm shelter construction documents, including the design information listed in Section 106.2.1, shall be prepared and sealed by a registered design professional.

Exception: The following items that are *listed* and *labeled* to indicate compliance with ICC 500 are not required to comply with this section:

1. Residential storm shelters.
2. Structural components and *impact-protective systems* installed in residential storm shelters.

108.1 Owner's statement of responsibility. For each *community storm shelter* the owner shall submit to the *authority having jurisdiction* a written statement of responsibility acknowledging the owner's responsibilities regarding shelter operation and maintenance with the application for a construction permit.

108.2 Emergency operation plan. For each *community storm shelter* the owner shall submit to the *authority having jurisdiction* a written emergency operations plan for the *storm shelter* prior to approval of the certificate of occupancy.

109.3 Peer reviewer disclosure. The peer reviewer shall ~~disclose to the owner or the owner's authorized agent and~~ to the *authority having jurisdiction* and the owner or the owner's authorized agent any possible conflicts of interest, financial or otherwise.

109.5.1 Changes. The registered design professional in responsible charge shall submit to the peer reviewer any changes to the design that occur after the initial peer review report and are related to the requirements of Section 109.1. If determined to be needed by the peer reviewer, an amended peer review report shall be submitted to the AHJ before such design changes are implemented.

110.1.2.1 ~~106.3.1~~ *Special inspections* to verify anchor installation. A *special inspection* shall be provided to verify the post-installed anchor installation and capacity in accordance with Section ~~107.2.1~~ 106.2.1. For post-installed anchorage to foundations, *special inspection* shall be provided to verify foundation adequacy in accordance with Sections ~~107.2.1~~ 106.2.1 and 307 ~~308~~.

Exception: For *residential storm shelters*, where the *authority having jurisdiction* verifies that the anchorage and, where required, the foundation complies with the requirements of the *storm shelter* design as provided in documentation required by Section ~~107~~ 106, *special inspection* is permitted to be waived by the *authority having jurisdiction*.

~~**SHELTER**~~ **ENTRY SYSTEM, ALCOVE OR BAFFLED** STORM **SHELTER.** An entry system that uses walls and passageways to allow access and egress to the *storm shelter* interior while providing shielding from wind-borne debris in accordance with Section ~~306.5~~ 306.4.4.

OCCUPIED STORM **SHELTER AREAS.** The designated *storm shelter* area ~~area~~ within the *storm shelter envelope* and excluding *occupant support areas*.

~~**ROLLOVER HAZARDS.** See "Hazards, Rollover."~~

STORM SHELTER. A building, structure or portion~~(s)~~ thereof, constructed in accordance with this standard, designated for use during a severe wind storm event such as a hurricane or tornado.

Community Storm Shelter. Any *storm shelter* not defined as a *residential storm shelter*. This includes both storm shelters intended for use by the general public and storm shelters intended for use by building occupants.

Residential Storm Shelter. A *storm shelter* serving occupants of dwelling units and having ~~an~~ ~~*a storm shelter*~~ ~~an occupant load~~ a *storm shelter design occupant capacity* not exceeding 16 persons.

~~**USEABLE**~~ **USABLE** STORM **SHELTER FLOOR AREAS.** The portions of the floor area within the *storm shelter envelope* not including *occupant support areas*, used to determine the maximum *storm shelter design occupant capacity* of the *storm shelter*.

303.1.1. Rainfall rate. The rainfall rate shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate. The 100-year, 1 hour rainfall rate shall be determined from Figure ~~303.2~~ 303.1.1 or ~~from~~ approved local weather data.

FIGURE 303.1.1**—continued**
100-YEAR, 1-HOUR RAINFALL (INCHES), WESTERN UNITED STATES

(IS-STM 03-15-18-AS, IS-STM 03-19-18 AM, IS-STM 03-20-18 AM) (IS-STM 03-28-18 AS)

306.4.6 ~~306.8~~ Joints, gaps or voids in *storm shelter envelope*. Joints, gaps or voids in a *storm shelter envelope* that opens into the *protected occupant area* similar to masonry control joints, expansion joints, opening protective device shim spaces, air louver blades, grates, grilles, screens or precast panel joints shall be considered openings and shall be protected in accordance with Sections ~~306.3 and 306.4~~ 306.4.1, 306.4.2 or 306.4.3.

Exceptions:

1. Masonry control joints, masonry or concrete expansion joints ~~or precast concrete panel joints~~ $^{3}/_{8}$-inch (9.5 mm) or less in width, sealed with joint material in accordance with TMS 602 for masonry or ASTM C920 for concrete.
2. Precast concrete panel joints shall be permitted to be 3/4-inches (19 mm) or less in width where sealed with joint material in accordance ASTM C920.
3. ~~2.~~ Joints, gaps or voids that will not allow a direct debris path through the *storm shelter envelope* into the *protected occupant area*. Debris particles 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.

402.4 Flood Information. Flood information shall be provided on the construction documents in accordance with Section ~~107.2.1~~ 106.2.1.

501.1 Scope. The requirements of this chapter shall govern the occupant density, access, accessibility, emergency egress, and signage for storm shelters.

503.2 ~~502.4~~ Occupant density. The minimum required *usable storm shelter floor area* per occupant for *residential storm shelters* shall be determined in accordance with Table ~~502.4~~ 503.2 and Section 503.3.

508.1 ~~504.1~~ Signage requirements. *Community storm shelter* areas shall be marked by signage in accordance with ~~this section~~ Sections 508.1.1 through 508.1.5. All storm shelters shall be marked with design information in accordance with Section 508.2. ~~Signage is required within a facility to direct occupants to storm shelter areas.~~ The signs shall comply with the visual character requirements of ICC A117.1.

508.2 ~~504.2~~ Design information. All *storm shelters* shall have a sign on or within the *storm shelter* with all of the following:

1. The *storm shelter occupant load.*
2. The storm type.
3. The *storm shelter design wind speed*.
4. The edition of the ICC 500 used for the design.
5. The name of the manufacturer or builder of the *storm shelter*.

(IS-STM 07-08-18 – AS, IS-STM 07-10-18 AS, IS-STM 07-18-18 AS)

702.2.2 Additional ~~facilities~~ sanitation stations for ~~storm~~ *tornado* ***shelters*****.** Where the required number of sanitation ~~facilities~~ stations for the *tornado shelter* exceeds the number of ~~facilities~~ stations provided for the normal occupancy of the space, the additional facilities shall be permitted to be temporary sanitary ~~fixtures~~ stations, such as chemical toilets or other means approved by the *authority having jurisdiction*.

(IS-STM 07-09-18 AM)

702.2.3 Urinals. Urinals shall be permitted to be substituted for water closets in accordance with the International Plumbing Code Section 424.

(IS-STM 07-09-18 AM)

702.2.4 Fixture calculations. The number of fixtures for each sex shall be allocated in accordance with the International Plumbing Code Section 403.1.1.

(IS-STM 07-19-18 AS, IS-STM 07-03-18 AM)

702.3 ~~702.1~~ Ventilation. Occupied space in *tornado shelters* shall be ~~ventilated by natural means~~ provided with *natural ventilation* in accordance with Section ~~702.1.1~~ 702.3.1 or ~~by~~ with mechanical ventilation in accordance with Section ~~702.1.2~~ 702.3.2. Openings used for atmospheric pressure change (APC) are permitted to be counted as ventilation for the purposes of this section. Ventilation openings for natural and mechanical ventilation shall comply with Section 702.3.3 and 702.3.4.

(IS-STM 07-03-18 AM, IS-STM 07-13-18 AM, IS-STM 07-17-18 AM, IS-STM 01-02-18 AM; IS-STM 07-05-18 AM, IS-STM 07-19-18 AS)

702.3.2 ~~702.1.2~~ Mechanical ventilation. *Tornado shelters* that rely on mechanical ventilation shall be provided with the minimum mechanical ventilation rate of required outdoor air at a minimum rate of 5 cubic feet per minute per occupant for the *storm shelter occupant load* ~~in accordance with the *applicable* building *code* provisions for the normal use of the space~~. The mechanical ventilation system shall be connected to ~~an emergency~~ a standby power system.

(IS-STM 07-09-18 AM)

703.2.3 Urinals. Urinals shall be permitted to be substituted for water closets in accordance with the International Plumbing Code Section 424.

(IS-STM 07-09-18 AM)

703.2.4 Fixture calculations. The number of fixtures for each sex shall be allocated in accordance with the International Plumbing Code Section 403.1.1.

703.4.1 ~~703.8.1~~ Rainfall rate for the primary roof drainage system. Rainfall rate for the primary roof drainage system of a *hurricane shelter* shall be determined by adding 3 inches (76.2 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate. The 100-year, 1 hour rainfall rate shall be determined from Figure ~~303.2~~ 303.1.1 or ~~from~~ approved local weather data.

703.4.2 ~~703.8.2~~ Rainfall rate for the secondary (overflow) drainage systems. The rainfall rate for the secondary (overflow) drainage systems shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the 100-year, 1-hour rainfall rate. The 100-year, 1 hour rainfall rate shall be determined from Figure ~~303.2~~ 303.1.1 or ~~from~~ approved local weather data.

703.4.3 ~~703.8.3~~ Rainwater drainage for *hurricane shelter* facilities. Rainwater drainage shall be provided for *hurricane shelter* facilities where ~~it is possible~~ that rainwater will be impounded and flood *occupied storm shelter areas*, occupant support areas and *storm shelter critical support systems* or access routes. The rainfall rate shall be determined by adding 6 inches (152.4 mm) per hour to the 100-year, 1-hour rainfall rate. The 100-year, 1 hour rainfall rate shall be determined from Figure ~~303.2~~ 303.1.1 or ~~from~~ approved local weather data.

703.5 ~~703.1~~ Ventilation. ~~Every occupied~~ Occupied space in *community hurricane shelters* with ~~an~~ occupant load a *storm shelter design occupant capacity* of 50 or greater ~~than 50~~ shall be ventilated by mechanical means in accordance with Section ~~703.1.1~~ 703.5.2. All *hurricane shelters* shall be provided with *natural ventilation* in accordance with Section ~~703.1.2~~ 703.5.1. Ventilation openings for natural and mechanical ventilation shall comply with Section *703.5.3* and 703.5.4.

703.5.1 ~~703.1.2~~ *Natural ventilation*. All *hurricane shelters* shall be provided with openings to facilitate minimum *natural ventilation* in accordance with this section. The area of ventilation openings shall comply with Table ~~703.1~~ 703.5.1. ~~and the location of openings shall be in accordance with Section 703~~. Where *hurricane shelters* are also designed as *tornado shelters*, openings provided to relieve internal pressure for atmospheric pressure change (APC) per Section 304.7 shall be permitted to be counted as *natural ventilation* openings.

(IS-STM 03-22-18 AM, IS-STM 07-19-18 AS) errata
703.7 ~~703.9~~ Electrical grounding and bonding of *hurricane shelters*. Exposed metal surfaces within *hurricane shelters* shall be electrically bonded and grounded ~~shall be electrically connected to the hurricane shelter's grounding electrode system where such grounded electrode systems exists~~ where required by Article 250 of NFPA 70 or by the authority having jurisdiction.

(IS-STM 10-04-18 AS, IS-STM 08-18-18 AS, IS-STM 03-11-18 AM, IS-STM 08-11-18 AM)
805.2 ~~806.2~~ ~~Roof and~~ wall assemblies and roof assemblies. ~~When~~ Where testing of wall assemblies and roof ~~and wall~~ assemblies is required, ~~they~~ such assemblies shall be pressure tested in the as-supplied condition. Pressure testing of roof assemblies shall be conducted in accordance with FM 4474, ASTM E1592, UL1897 or ASTM E330, whichever is applicable, to a pressure 1.2 times the *design wind pressure* or greater. ~~Required~~ Pressure testing of wall assemblies shall be ~~done as detailed in~~ conducted in accordance with ASTM E330 to ~~a pressure equal to or higher than~~ 1.2 times the ~~pressures specified in Section 304~~ *design wind pressure* or greater.

805.3 ~~806.3~~ Door assemblies. Door assemblies shall be pressure tested in the as-supplied condition and, ~~when~~ where required, they shall be static pressure tested or cyclically tested as specified in ~~the following sections:~~ Sections 805.3.1 through 805.3.2.2.

805.3.1.2 ~~806.3.1.2~~ Door assemblies without glazing for *hurricane shelters*. Door assemblies without glazing for use in *hurricane shelters* shall be static pressure proof tested ~~away from the door~~

~~stops~~ to a pressure of ~~at least~~ 1.2 times the *design wind pressure* or greater, then subjected to required debris impact tests, and then to cyclic pressure tests following procedures of ASTM E1886.

Alternatively, door assemblies without glazing for *hurricane shelters* shall be statically pressure tested ~~away from the door stops~~ to a pressure of 1.5 times the *design wind pressure* or greater before impact tests and then to required debris impact tests. Cyclic pressure testing after impact tests is not required for these door assemblies that have been pressure tested to pressures equal to ~~or greater than~~ 1.5 times the *design wind pressure* or greater.

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24—| Flood Resistant Design and Construction 401.3

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