GG338-14

Appendix E (New)

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Add new text as follows:

APPENDIX E
ENHANCED BUILDING RESILIENCE

The provisions in this appendix are not mandatory unless specifically referenced in the adopting ordinance. The provisions of this appendix are intended to take precedence over the requirements of the International Building Code in an effort to achieve an enhanced level of resiliency consistent with premise of green building design and construction.

SECTION E101
GENERAL

E101.1 Purpose. The purpose of this appendix is to promote enhanced public health, safety and general welfare and to reduce public and private property losses due to hazards and natural disasters associated with fires, flooding, high winds and earthquakes.

SECTION E102
BUILDING HEIGHTS AND AREA

E102.1 General. In order to limit the impact of fires on the *building* the *building* shall comply with Sections E102.1 through E102.3 and the requirements for Chapter 5 General Building Heights and Areas of the *International Building Code.*

E102.2 Building height, number of stories and allowable area. Building height, numbers of stories and allowable area shall be determined in accordance with E102.2.1 through E102.2.4

E102.2.1 Height in feet. The maximum height, in feet, of a building shall not exceed the limits specified in Table E102 (1). Table E102 (1) shall be used in lieu of Table 504.3, ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE, in the *International Building Code*

TABLE E102(1)
ALLOWABLE HEIGHT AND BUILDING AREAS[a]

Building height limitations shown in feet above grade plane. Story limitations shown as stories above grade plane. Building area limitations shown in square feet, as determined by the definition of "Area, building," per story

		TYPE OF CONSTRUCTION					
		Type I		Type II	Type III	Type IV	Type V
		A	B	A	A	HT	A
	HGT (feet)	UL	160	65	65	65	50
GROUP	STORIES (S) Area (A)						
A-1	S A	UL UL	5 UL	3 15,500	3 14,000	3 15,000	2 11,500
A-2	S	UL	11	3	3	3	2

		TYPE OF CONSTRUCTION					
		Type I		Type II	Type III	Type IV	Type V
		A	B	A	A	HT	A
	HGT (feet)	UL	160	65	65	65	50
GROUP	STORIES (S) Area (A)						
	A	UL	UL	15,500	14,000	15,000	11,500
A-3	S A	UL UL	11 UL	3 15,500	3 14,000	3 15,000	2 11,500
A-4	S A	UL UL	11 UL	3 15,500	3 14,000	3 15,000	2 11,500
A-5	S A	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL
B	S A	UL UL	11 UL	5 37,500	5 28,500	5 36,000	3 18,000
E	S A	UL UL	5 UL	3 26,500	3 23,500	3 25,500	1 18,500
F-1	S A	UL UL	11 UL	4 25,000	3 19,000	4 33,500	2 14,000
F-2	S A	UL UL	11 UL	5 37,500	4 28,500	5 50,500	3 21,000
H-1	S A	1 21,000	1 16,500	1 11,000	1 9,500	1 10,500	1 7,500
H-2[d]	S A	UL 21,000	3 16,500	2 11,000	2 9,500	2 10,500	1 7,500
H-3[d]	S A	UL UL	6 60,000	4 26,500	4 17,500	4 25,500	2 10,000
H-4	S A	UL UL	7 UL	5 37,500	5 28,500	5 36,000	3 18,000
H-5	S A	4 UL	4 UL	3 37,500	3 28,500	3 36,000	3 18,000
I-1	S A	UL UL	9 55,000	4 19,000	4 16,500	4 18,000	3 10,500
I-2	S A	UL UL	4 UL	2 15,000	1 12,000	1 12,000	1 9,500
I-3	S A	UL UL	4 UL	2 15,000	2 10,500	2 12,000	2 7,500
I-4	S A	UL UL	5 60,500	3 26,500	3 23,500	3 25,500	1 18,500
M	S A	UL UL	11 UL	4 21,500	4 18,500	4 20,500	3 14,000
S-1	S A	UL UL	11 48,000	4 26,000	3 26,000	4 25,500	3 14,000
S-2[b, c]	S A	UL UL	11 79,000	5 39,000	4 39,000	5 38,500	4 21,000
U[c]	S A	UL UL	5 35,500	4 19,000	3 14,000	4 18,000	2 9,000

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

UL = Unlimited, NP = Not permitted.

E102.2.1.1 Towers, spires, steeples and other roof structures. Towers, spires, steeples and other roof structures shall be permitted to meet the requirements in Section 504.3, Height in feet, of the *International Building Code.*

E102.2.2 Number of stories. The maximum number of stories of a building shall not exceed the limits specified in Table E102 (1). Table E102 (1) shall be used in lieu of Table 504.4, ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE, in the *International Building Code*

E102.2.3 Allowable area factor, A_t. The allowable area factor, A_t, to be used in determining the allowable area of a building in accordance with Section 506.2.1, 506.2.3 or 506.2.4 of the *International Building Code* shall be as specified in Table E102 (1). For application of Equations 5-1, 5-2 and 5-3 of the *International Building Code,* the value of NS shall be equal to the allowable area factor, A_t, from Table E102(1). Table E102(1) shall be used lieu of Table 506.2, ALLOWABLE AREA FACTOR
(A_t = NS, S1, S13R, or SM, as applicable) IN SQUARE FEET, in the *International Building Code*

E102.2.4 Specific exceptions to Table E102 (1). See Chapter 4 of the *International Building Code* for specific exceptions to the height, in feet, number of stories and allowable area of buildings determined based on Table E102 (1)

E102.3 Mixed occupancy and incidental use separations. All buildings containing mixed occupancies and incidental uses shall be provided with fire rated separations in accordance with Sections E102.3.1 and E102.3.2.

E102.3.1 Mixed occupancy separations. All occupancies except incidental uses in Table E102 (3) shall be separated from each other by fire barriers in accordance with Table E102(2). Table E102 (2) shall be used in lieu of Table 508.4 REQUIRED SEPARATION OF OCCUPANCIES (HOURS)in the *International Building Code*

TABLE E102(2)
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

Occupancy	**A[d]**	**E**	**B**	**I**	**F-2, S-2[b,c], U[b]**	**F-1, S-1, M**	**H-1**	**H-2**	**H-3, H-4, H-5**
A[d]	N	2	2	2	1	2	NP	4	3
E[d]	—	N	2	2	1	2	NP	4	3
B	—	—	N	2	1	2	NP	3	2
I	—	—	—	N	2	2	NP	NP	NP
F-2, S-2[b,c], U[c]	—	—	—	—	N	2	NP	4	3[a]
F-1, S-1, M	—	—	—	—	—	N	NP	3	2[a]
H-1	—	—	—	—	—	—	N	NP	NP
H-2	—	—	—	—	—	—	—	N	1
H-3, H-4, H-5	—	—	—	—	—	—	—	—	N

N = No separation requirement.
NP = Not permitted.
a. See Section 420 of the *International Building Code*.
b. Areas used only for private or pleasure vehicles shall be allowed to reduce separation by 1 hour.
c. See Section 406.3.4 of the *International Building Code*.
d. Except as required in Section E104.7.1, E104.7.2, E104.9.1 and E 104.9.2, separation is not required between occupancies of the same classification.

E102.3.2 Separation of incidental uses. Incidental accessory occupancies shall be separated from the remainder of the *building* by fire barriers with a fire resistance rating in accordance with

Table E102 (3). Table E102 (3) shall be used in lieu of Table 509 INCIDENTAL USES in the *International Building Code.*

TABLE E102(3)
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour
Refrigerant machinery rooms	1 hour
Hydrogen cut-off rooms, not classified as Group H	1-hour in Group B, F, M, S and U occupancies. 2-hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hour and provide *automatic sprinkler system*
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours and provide automatic fire-extinguishing system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide *automatic sprinkler system*
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide *automatic sprinkler system*
In Group I-2 laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops.	1 hour
In ambulatory care facilities or Group I-2 occupancies waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Stationary storage battery systems having a liquid electrolyte capacity of more than 50 gallons for flooded lead-acid, nickel cadmium or VRLA , or more than 1000 pounds for lithium-ion and lithium metal polymer used for facility standby power, emergency power or uninterrupted power supplies	1-hour in Group B, F, M, S and U occupancies. 2-hours in Group A, E, I and R occupancies.

SECTION E103
TYPES OF CONSTRUCTION

E103.1 General. In order to limit the impact of fires on the *building* the *building* shall comply with Section E103.2 and the requirements in Chapter 6, Types of Construction of the *International Building Code.*

E103.2 Fire-resistance rating. Building elements shall have a fire resistance rating not less than that specified in Table E103 (1) and exterior walls shall have a fire resistance rating not less than that specified in Table 602, Fire-Resistance Rating for Exterior Walls Based on Fire Separation Distance of the *International Building Code*. Table E103 (1) shall be used in lieu of Table 601 FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS) in the *International Building Code.*

TABLE E103
FIRE-RESISTANCE RATING FOR BUILDING ELEMENTS (HOURS)[a]

BUILDING ELEMENT	**TYPE I**		**TYPE II**		**TYPE III**		**TYPE IV**	**TYPE V**	
	A	**B**	**A**	**B**	**A**	**B**	**HT**	**A**	**B**
Primary Structural Frame[g,h]	3[b]	2[b]	1	NP	1	NP	HT	1	NP
Bearing Walls Exterior[f,g] Interior	 3 3[b]	 2 2[b]	 1 1	 NP NP	 2 1	 NP NP	 2 1/HT	 1 1	 NP NP
nant Separation sidential spaces n-residential spaces ll tenant spaces	 See Section E104.7.1 and E104.9.1 See Section E104.7.2 and E104.9.2 See Section 402.4.2.1 of the *IBC*								
Non-bearing Walls and Partitions Exterior	See Table 602 of the *IBC*								
Non-bearing Walls and Partitions[e] Interior	0	0	0	NP	0	NP	See Section 602.4.6 of the *IBC*	0	NP
Floor Construction and Secondary Members[h]	2	2	1	NP	1	NP	HT	1	NP
Roof Construction and Secondary Members[h]	1-1/2[b]	1[c,d]	1[c,d]	NP	1[c,d]	NP	HT	1[c,d]	NP

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
a. The requirements in this table take precedence over Table 601,*Fire resistance rating for building elements* of the *International Building Code*.
b . Roof supports: Fire-resistance rating of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
c . Fire protection of structural members hall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire retardant wood members shall be allowed to be used for such unprotected members.
d . In all occupancies, heavy timber shall be allowed where 1-hour or less fire-resistance rating is required.
e. Not less than the fire-resistance rating required by other Sections of the *International Building Code*.
f. Not less than the fire-resistance rating based on fire separation distance (see Table 602 of the *International Building Code*)
g . Not less than the fire-resistance rating as referenced in Section 704.10 of the *International Building Code*, *Exterior structural; elements*.
h. See Section 202 of the *International Building Code*, *Definitions*.

SECTION E104
FIRE PROTECTION FEATURES

E104.1 General. In order to limit the impact of fires on the *building* the *building* shall comply with Sections E104.1 through E104.12 and the requirements for Chapter 7 Fire and Smoke Protection Features of the *International Building Code.*

E104.2 Allowable area of openings. The maximum area of unprotected and protected openings permitted in an exterior wall in any story of the building shall not exceed the percentages specified in TableE104 (1). Table E104 (1) shall be used in lieu of Table 705.8 MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION in the *International Building Code*

TABLE E104(1)
MAXIMUM AREA OF EXTERIOR WALL OPENING BASED ON FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION[a]

Fire Separation Distance (feet)	**Degree of Opening Protection**	**Allowable Areas[b]**
0 to less than 3[c,d]	Unprotected (UP)	Not Permitted
	Protected (P)	Not Permitted
3 to less than 5[e]	Unprotected (UP)	Not Permitted
	Protected (P)	15%
5 to less than 10[g]	Unprotected (UP)	10%
	Protected (P)	25%
10 to less than 15[f,g]	Unprotected (UP)	15%
	Protected (P)	45%
15 to less than 20[f,g]	Unprotected (UP)	25%
	Protected (P)	75%
20 to less than 25[f,g]	Unprotected (UP)	45%
	Protected (P)	No Limit
25 to less than 30[f,g]	Unprotected (UP)	70%
	Protected (P)	No Limit
30 or greater	Unprotected (UP)	No Limit
	Protected (P)	Not Required

For SI: 1 foot = 304.8 mm
UP = Unprotected openings in buildings
P = Openings protected with an opening protective assembly in accordance with section 704.8.2 of the ICC *International Building Code*

a. The requirements in this table take precedence over Table 705.8,F*Maximum area of exterior wall openings based on fire separation distance and degree of opening protections o*f the Code.
b. Values indicated are the percentage of the area of the exterior wall per story.
c. For the requirements for fire walls of buildings with differing heights see Section 705.6.1 of the ICC *International Building Code.*
d. For openings in a fire wall for building son the same lot, see Section 705.8 of the ICC *International Building Code.*
e. The maximum percentage of unprotected and protected openings shall be 25% for Group R-3 occupancies.
f. The area of unprotected and protected openings shall not be limited for Group R-3 occupancies with a fire separation distance of 5 feet or greater.
g. *International Building Code* Includes buildings accessory to Group R-3.

E104.3 Protected openings. The exception for opening protectives in Section 705.8.2, Protected openings of the *International Building Code*, shall not be permitted.

E104.4 Vertical separation of openings. Exception 2 that eliminates vertical separation of openings where automatic sprinklers are present in Section 705.8.5, Vertical separation of openings of the *International Building Code*, shall not be permitted.

E104.5 Parapets. Exceptions 4 and 5 in Section 705.11, Parapet construction of the *International Building Code* that eliminates exterior wall parapets shall not be permitted for Group R-2 occupancies.

E104.6 Fire walls. Fire walls shall meet the requirements of this section.

E104.6.1Materials. Fire walls for all types of construction shall be of any approved noncombustible material permitted in NFPA 221.

E104.6.2 Fire-resistance rating. The fire-resistance ratings shall meet or exceed the ratings provided in Table E104 (2). Table E104 (2) shall be used in lieu of Table 706.4 FIRE WALL FIRE-RESISTANCE RATINGS in the *International Building Code*

TABLE E104(2)
FIRE WALL FIRE-RESISTANCE RATINGS

GROUP	FIRE-RESISTANCE RATING (hours)
A, B, E, H-4, I, R-1, R-2, U	3
F-1, H-3[a], H-5, M, S-1	3
H-1, H-2	4[a]
F-2, S-2, R-3, R-4	2

a. For Group H-1, H-2 or H-3 buildings, also see Sections 415.4 and 415.5 of the International Building Code.

E104.6.3 Horizontal continuity. Exception 3 in Section 706.5, Horizontal continuity of the *International Building Code* that allows termination of fire walls at the interior surface of noncombustible exterior sheathing where *automatic sprinkler systems* are present shall not be permitted.

E104.6.4 Vertical continuity. Exceptions 2 and 4 in Section 706.6, Vertical continuity of the *International Building Code* that allows termination of fire walls at the underside of roof sheathing or decks shall not be permitted.

E104.6.5 Openings. Exception 2 in Section 706.8, Openings of the *International Building Code* that allows increased area of openings through fire walls where *automatic sprinkler systems* are present shall not be permitted.

E104.7 Fire barriers. Fire barriers shall comply with the provisions of this section

E104.7.1 Separation of dwelling units and sleeping units. The separation between individual *dwelling units* and *sleeping units*, and between *dwelling units* and *sleeping units* and other spaces in the building shall be *fire barrier* assemblies or *horizontal assemblies* with a minimum *fire-resistance rating* of 2- hour.

E104.7.2 Separation of tenant spaces. Individual tenant spaces in a building shall be separated by *fire barrier* assemblies or *horizontal assemblies*, or both, with a minimum *fire-resistance rating* of 1-hour and the requirements of Section 508 Mixed Use and Occupancy of the *International Building Code*.

E104.7.3 [Add Section Title Here] Exception 1 in Section 707.6, Openings of the *International Building Code* that allows openings in a fire barrier to be larger than 156 sq ft where *automatic sprinkler systems* are provided shall not be permitted.

E104.8 Fire partitions. Fire partitions shall comply with the provisions of this section.

E104.8.1[Add Section Title Here] Fire partitions in Section 708.1, General of the *International Building Code*, shall not be permitted for walls separating dwelling units in the same building.

E104.8.2[Add Section Title Here] Fire partitions in Section 708.1, General of the *International Building Code*, shall not be permitted for walls separating sleeping units in the same building.

E104.8.3[Add Section Title Here] Fire partitions in Section 708.3, Fire-resistance rating of the *International Building Code*, shall not be permitted for corridor walls separating corridors from dwelling units or sleeping units in the same building.

E104.8.4[Add Section Title Here] Exceptions 1 and 2 in Section 708.3, Fire-resistance rating of the *International Building Code* that allows a reduction in the fire resistance rating of corridors and separations between dwelling units and sleeping units shall not be permitted.

E104.8.5[Add Section Title Here] Exception 6 in Section 708.4, Continuity of the *International Building Code* that allows elimination of fireblocking or draftstopping shall not be permitted.

E104.9 Horizontal assemblies. Horizontal assemblies shall comply with the requirements of this Section.

E104.9.1 Separation of dwelling units and sleeping units. The separation between individual *dwelling units* and *sleeping units*, and between *dwelling units* and *sleeping units* and other spaces in the building shall be *fire barrier* assemblies or *horizontal assemblies* with a minimum *fire-resistance rating* of 2- hour.

E104.9.2 Separation of tenant spaces. Individual tenant spaces in a building shall be separated by *fire barrier* assemblies or *horizontal assemblies*, or both, with a minimum *fire-resistance rating* of 1-hour and the requirements of Section 508, Mixed Use and Occupancy of the *International Building Code*.

E104.9.3[Add Section Title Here] The exception in Section 711.2.4.3, Fire-resistance rating of the *International Building Code* that allows a reduction of the fire-resistance rating of separations between dwelling unit and sleeping unit where *automatic sprinkler systems* are present shall not be permitted.

E104.10 Enclosed elevator lobby. Sprinkler protection or smoke partitions shall not be permitted to substitute for fire partitions in accordance with Section 708 for elevator lobby enclosures in Section 3007. Elevator lobbies of the *International Building Code* where fire partitions are required.

E104.11 Opening protectives. The provisions of this section shall apply to opening protectives.

E104.11.1[Add Section Title Here] The Exception in Section 716.5.5 Doors in interior exit stairways and ramps and exit passageways of the *International Building Code*, that eliminate the maximum transmitted temperature requirements shall not be permitted.

E104.12 Concealed spaces. The provisions of this section shall apply to concealed spaces.

E104.12.1 Groups R-1, R-2, R-3 and R-4. Exceptions 1 and 2 in Section 718.3.2, Groups R-1, R-2, R-3 and R-4 of the *International Building Code* that eliminate draftstopping where *automatic sprinkler systems* are present shall not be permitted for Groups R-1, R-2 or R-4 occupancies.

E104.12.2 Other groups. The exception in Section 718.3.3 Other groups of the *International Building Code* that eliminates draftstopping where *automatic sprinkler systems* are present shall not be permitted.

SECTION E105
INTERIOR FINISHES

E105.1 General. In order to limit the impact of fires on the *building* the *building* shall comply with Sections E105.1 through E105.3 and the requirements for Chapter 8 Interior Finishes of the *International Building Code.*

E105.2 Interior wall and ceiling finishes. Interior wall and ceiling finishes and conform to the requirements of this section.

E105.2.1Finish by occupancy. Interior wall and ceiling finishes based on occupancy shall conform to the requirements in Table E105(1). Table E105(1) shall be used in lieu of Table 803.9 INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY in the *International Building Code.*

TABLE E105
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY

GROUP	EXIT ENCLOSURES AND EXIT PASSAGEWAYS[a]	CORRIDORS	ROOMS AND ENCLOSED SPACES[b]
A-1, A-2	A	A	B
A-3, A-4, A-5	A	A	C
B, E, M, R-1, R-4	A	B	C
F	B	C	C
H	A	A	B
I-1	A	B	B
I-2, I-3, I-4	A	A	B
R-2	B	B	C
R-3	A	C	C
S	B	B	C
U	No Restrictions		

For SI: 1 inch = 25.4 mm, 1 square inch = 0.0929m2

a. Class C interior finish materials shall be permitted for wainscoting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fire blocked as required by Section 803.11.1 of the *International Building Code*.

b. Requirements for rooms and enclosed spaces shall be based upon spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered enclosing spaces and rooms or spaces on both sides shall be considered as one. In determining the applicability of the requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.

E105.2.2 Set-out construction. Exception 1 in Section 803.11.2, Set out construction of the *International Building Code* for the Class A interior finish materials where *automatic sprinkler systems* are provided shall not be permitted.

E105.3 Interior floor finishes. The Exception in Section 804.4.2Minimum critical radiant flux of the *International Building Code International Building Code*, which eliminates the requirement for minimum critical radiant flux for floor finishes and floor coverings in exit enclosures, exit passageways, and corridors where *automatic sprinkler systems* are provided shall not be permitted.

SECTION E106
FIRE PROTECTION FEATURES

E106.1 General. In order to limit the impact of fires on the *building* the *building* shall comply with Sections E106.2 through E106.5 and the requirements for Chapter 9 Fire Protection Features of the *International Building Code*

E106.2 Automatic sprinkler protection. An *approved automatic sprinkler systems* shall be provided throughout all new buildings in accordance with Section E106.2.1 through E106.2.7.

E106.2.1 Group A. An *automatic sprinkler system* shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section.

E106.2.1.1 Group A-1. An *automatic sprinkler system* shall be provided for Group A-1 occupancies where one of the following conditions exists:

1. The *fire area* exceeds 6,000 square feet (557.5m^2);
2. The *fire area* has an *occupant load* of 150 or more;
3. The *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies; or
4. The *fire area* contains a multitheater complex.

E106.2.1.2 Group A-2. An *automatic sprinkler system* shall be provided for Group A-2 occupancies where one of the following conditions exists:

1. The *fire area* exceeds 2,500 square feet (232.2m^2);
2. The *fire area* has an *occupant load* of 50 or more; or
3. The *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies.

E106.2.1.3 Group A-3. An *automatic sprinkler system* shall be provided for Group A-3 occupancies where one of the following conditions exists:

1. The *fire area* exceeds 6,000 square feet (557.5m^2);
2. The *fire area* has an *occupant load* of 150 or more; or
3. The *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies.

E106.2.1.4 Group A-4. An *automatic sprinkler system* shall be provided for Group A-4 occupancies where one of the following conditions exists:

1. The *fire area* exceeds 6,000 square feet (557.5m^2);
2. The *fire area* has an *occupant load* of 150 or more; or
3. The *fire area* is located on a floor other than a *level of exit discharge* serving such occupancies.

E106.2.2 Group E. An automatic sprinkler system shall be provided for Group E occupancies as provided in this section:

1. Throughout all Group E fire areas greater than 6,000 square feet (557.5 m2) in area.
2. Throughout every portion of educational buildings below the lowest level of exit discharge serving that portion of the building.

   Exception: An automatic sprinkler system is not required in any area below the lowest level of exit discharge serving that area where every classroom throughout the building has at least one exterior exit door at ground level.

E106.2.3 Group F-1. An *automatic sprinkler system* shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. A Group F-1 *fire area* exceeds 6,000 square feet (557.5m^2);
2. A Group F-1 *fire area* is located more than three stories above *grade plane*.
3. The combined area of all Group F-1 *fire areas* on all floors, including any mezzanines, exceeds 12,000 square feet (1105m^2).
4. A Group F-1 occupancy used for the manufacture of upholstered furniture or mattresses exceeds 2,500 square feet (232 m2).

E106.2.3.1 Woodworking operations. An *automatic sprinkler system* shall be provided throughout all Group F-1 occupancy *fire areas* that contain woodworking operations in excess of 2,500 square feet (232 m^2) in area which generate finely divided combustible waste or use finely divided combustible materials.

E106.2.4 Group M. An *automatic sprinkler system* shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:

1. A Group M *fire area* exceeds 6,000 square feet (557.5m^2);
2. A Group M *fire area* is located more than three stories above *grade plane*.
3. The combined area of all Group M *fire areas* on all floors, including any mezzanines, exceeds 12,000 square feet (1105m^2).
4. A Group M occupancy used for the display and sale of upholstered furniture or mattresses exceeds 2,500 square feet (232m^2).

E106.2.5 Group S-1. An *automatic sprinkler system* shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

1. A Group S-1*fire area* exceeds 6,000 square feet (557.5m^2);
2. A Group S-1*fire area* is located more than three stories above *grade plane*.
3. The combined area of all Group S-1*fire areas* on all floors, including any mezzanines, exceeds 12,000 square feet (1105m^2).
4. A Group S-1 *fire area* used for the storage of commercial trucks or buses where the *fire area* exceeds 2,500 square feet (232m^2).
5. A Group S-1 occupancy used for the display and sale of upholstered furniture or mattresses exceeds 2,500 square feet (2326m^2).

E106.2.5.1 Repair garages. An *automatic sprinkler system* shall be provided throughout all buildings used as repair garages in accordance with Section 406 of the *International Building Code*, as shown:

1. Buildings having two or more *stories above grade plane*, including basements, with a *fire area* containing a repair garage exceeding 5000 square feet (464 m^2).
2. Buildings no more than one *story above grade plane*, with a *fire area* containing a repair garage exceeding 6,000 square feet (557.5m^2).
3. Buildings with repair garages servicing vehicles parked in basements. 4. A Group S-1 *fire area* used for the repair of commercial trucks or buses where the *fire area* exceeds 2,500 square feet (232m^2).
4. A Grpi[S-1 *fire area* usd for the repair of commercial trucks or buses where the fire area exceeds 2500 square feet (232m^2)

E106.2.5.2 Bulk storage of tires. Buildings and structures where the area for the storage of tires exceeds 10,000 cubic feet (283m^3) shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 of the *International Building Code*.

E106.2.6 Group S-2 enclosed parking garages. An *automatic sprinkler system* shall be provided throughout buildings classified as enclosed parking garages in accordance with Section 406.4 Public parking garages of the *International Building Code* as follows:

1. Where the *fire area* of the enclosed parking garage exceeds 6,000 square feet (557.5m^2); or
2. Where the enclosed parking garage is located beneath other groups.

   Exception: Enclosed parking garages located beneath Group R-3 occupancies.

E106.2.7 Group B. An *automatic sprinkler system* shall be provided throughout buildings containing a Group B occupancy where one of the following conditions exists:

1. A Group B *fire area* exceeds 6,000 square feet (556 m^2).
2. A Group B *fire area* is located more than three stories above *grade plane*.
3. The combined area of all Group B *fire areas* on all floors, including any mezzanines, exceeds 12,000 square feet (1,115 m^2).

E106.3 Automatic Sprinkler Systems. Sprinkler systems shall be designed and installed in accordance with Section 903.3.1.1 NFPA 13 sprinkler systems of the *International Building Code*,. Sprinkler systems designed and installed in accordance with Section 903.3.1.2 NFPA 13R sprinkler systems of the *International Building Code* shall not be permitted.

E106.4 Standpipes. Standpipes shall comply with the requirements of this Section.

E106.4.1[Add Section Title Here] The exception to Section 905.4.1, Protection of the *International Building Code* that allows elimination of the fire-resistance rated enclosure for laterals where *automatic sprinkler systems* are provided shall not be permitted.

E106.5Fire Alarm and Detection Systems. Fire alarms and detection systems shall comply with the provisions of this Section.

E106.5.1 Manual pull station. The number of manual pull stations required in Section 907, Fire alarm and detection systems, of the International Building Code for fire alarm systems shall not be permitted to be reduced or eliminated where automatic sprinkler systems are provided.

SECTION E107
MEANS OF EGRESS

E107.1 General. In order to limit the impact of fires on the *building* the *building* shall comply with Sections E107.1 through E107.7 and the requirements for Chapter 10 Means of Egress of the *International Building Code*.

E107.2 Means of egress capacity factor. The means of egress capacity factor used for calculating the egress capacity for stairways in Section 1005.3.1 Stairways of the *International Building Code* shall be 0.3 inch (7.6 mm) per occupant with no reduction for automatic sprinkler protection in the building. The means of egress capacity factor used for calculating the egress capacity for other egress components in Section 1005.3.2 Other egress components of the *International Building Code* shall be 0.2 inch (5.1 mm) per occupant with no reduction for automatic sprinkler protection in the building.

E107.3.Accessible means of egress. Accessible means of egress shall comply with the requirements of this Section.

E107.3.1 Exception 2 of Section 1007.3, Stairways, of the *International Building Code* that reduces in the clear width between handrails shall not be permitted.

E107.3.2[Add Section Title Here] Exception 3 of Section 1007.3, Stairways, of the *International Building Code* that eliminates of areas of refuge shall not be permitted.

E107.3.3[Add Section Title Here] Exception 2 of Section 1007.4, Elevators, of the *International Building Code* that eliminates requirements for elevator access from areas of refuge or horizontal exit shall not be permitted.

E107.4 Stairways. The exception for Section 1007.7.4 Stairways, of the *International Building Code* that reduces in the clear width between handrails shall not be permitted.

E107.5 Exit access. The common path of travel shall comply with the requirements in Table E107 (1). Table E107 (1) shall be used in lieu of Table 1006.2.1 SPACES WITH ONE EXIT OR EXIT ACCESS DOORWAY in the *International Building Code.*

Table E107(1)
Spaces With One Exit or One Exit Access Doorway

OCCUPANCY	MAXIMUM OCCUPANT LOAD OF SPACE	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE (feet) OCCUPANT LOAD	
		OL < 30	OL > = 30
A, E, M	49	75	75
B	49	100	75
F	49	75	75
H-1, H-2, H-3	3	25	25
H-4, H-5, I-1, I-2, I-4, R-1, R-3, R-4	10	75	75
I-3	10	100	100
R-2	10	125	125
R-3	10	125	125
S	29	100	75
U	49	100	75

For SI: 1 foot = 304.8 mm

E107.6 Exits and exit access doorways. Exits and exit access doorways shall comply with the requirements of this Section.

E107.6.1[Add Section Title Here] Exception 1 in Section 1016.2.1, Egress based on occupant load and common path of egress travel, of the *International Building Code* that reduces the number of means of egress shall not be permitted.

E107.6.2[Add Section Title Here] Exception 1 of Section 1007.1.1, Two exits or exit access doorways, of the *International Building Code* that counts scissor stairs as two exits shall not be permitted.

E107.7 Exit access travel distance. Exit access travel distance shall comply with the requirements in Table E107 (2) and this Section. Table E107 (2) shall be used in lieu of Table 1016.2 EXIT ACCESS TRAVEL DISTANCE in the *International Building Code.*

Table E107(2)
Exit Access Travel Distance

OCCUPANCY	DISTANCE (ft)
A, E, F-1, M, R, S-1	200
I-1, I-2	200
B	200
F-2, S-2, U	300
H-1	75
H-2	100
H-3	150
H-4	175
H-5	200
I-3, I-4	150

a. See the following sections of the *International Building Code* for modifications to *exit access* travel distance requirements:
Section 402.8: For the distance limitation in *malls*.
Section 404.9: For the distance limitation through an *atrium* space.
Section 407.4: For the distance limitation in Group I-2.
Sections 408.6.1 and 408.8.1: For the distance limitations in Group I-3.
Section 411.4: For the distance limitation in special amusement buildings.
Section 1006.2.2.2: For the distance limitation in refrigeration machinery rooms.
Section 1006.2.2.3: For the distance limitation in refrigerated rooms and spaces.
Section 1006.3.3 For buildings with one *exit*.
Section 1028.7: Increased distance limitation shall only apply to smoke-protected and open-air assembly seating.
Section 3103.4: For temporary structures.
Section 3104.9: Increased distance limitation shall only apply to pedestrian walkways in accordance with Exception No. 2.

.**E107.7.1[Add Section Title Here]** Distance limitations through atrium spaces shall conform to Section 404, Atriums of the *International Building Code*.

E107.7.2[Add Section Title Here] Exit access in buildings with one exit shall conform to Section 1006.3.3, Single exits of the *International Building Code*

E107.8 Corridors. Corridors shall comply with the requirements of this Section.

E107.8.1[Add Section Title Here] The fire-resistance rating of corridor walls shall be at least 1-hour.

E107.8.2[Add Section Title Here] Exception 2 in Section 1019.4, Dead ends, of the *International Building Code* that increases the length of dead-end corridors shall not be permitted.

SECTION E108

EXTERIOR WALLS

E108. 1 General. Exterior wall coverings shall comply with Sections E108.2 through E108.4 and the requirements for Exterior Walls in Chapter 14 and Plastics in Chapter 26 of the International Building Code.

E108.2Exterior wall covering limitations for reduced damage from fire. Exterior wall coverings shall comply with E108.2.1 and E108.2.2 to reduce damage from fire exposure.

Exception. These criteria shall not apply where Sections 1406.2.1 through 1406.2.3 of the *International Building Code* are satisfied.

E108.2.1Vinyl siding and Exterior insulation and finish systems (EIFS). Vinyl siding and Exterior insulation and finish systems (EIFS) shall only be permitted to be installed on exterior walls of buildings with a minimum fire separation distance of 30 feet.

E108.2.2Fire Separation 5 Feet or Less. Combustible exterior wall coverings are not permitted on exterior walls having a fire separation distance or 5 feet (1524 mm) or less.

E108.3Exterior wall covering limitations for reduced damage from hail. Vinyl siding and Exterior insulation and finish systems (EIFS) shall comply with sections E108.3.1 and E108.3.2.

E108.3.1Hail Exposure regions. Hail exposure regions in Figure E108 (1) shall be as follows:

(a) **Moderate** - One or more hail days with hail diameters greater than 1.5 in (38 mm) in a twenty (20) year period.

(b) **Severe** - One or more hail days with hail diameters greater than 2.0 in (50 mm) in a twenty (20) year period.

E108.3.2 Exterior wall coverings subject to hail exposure. Wall coverings used in regions where hail exposure is Moderate or Severe, as determined in accordance with Section E108.3.1 and Figure E108 (1), shall be tested, classified, and labeled in accordance with UL 2218 or FM 4473.

E108.4 Exterior wall covering limitations for reduced damage from wind. Vinyl siding and Exterior insulation and finish systems (EIFS) shall only be permitted to be installed on exterior walls of buildings located as follows:

1. Regardless of the Risk Category, in areas where V_{ult} as determined in accordance with Figure 1609A does not exceed 115 miles per hour (45 m/s) and the *building height* is less than or equal to 40 feet (12 192 mm) in Exposure C.
2. Regardless of the Risk Category, in areas where V_{ult} as determined in accordance with Figure 1609A exceeds 115 miles per hour (45 m/s) or the *building height* is equal to 40 feet (12192 mm) or greater in Exposure C, vinyl siding shall be permitted on exterior walls when tested in accordance with ASTM D5206 using wind speed not less than the wind speed applicable for the building location.

SECTION E109
ROOF ASSEMBLIES

E109.1 General. Roof coverings shall also comply with Sections E109.2 through E109.4 and the requirements for Chapter 15 Roof Assemblies and Rooftop Structures of the *International Building Code,*

E109.2 Non-classified roofs. Non-classified roof coverings in accordance with Section 1505.5 Non-classified roofing of the International Building Code shall not be permitted on buildings.

E109.3 Roofs in Warm and Dry Climates. Roofs in climate zones 1, 2, 3, 4, 5B (dry), and 6B (dry) of the *International Energy Conservation Code (IECC)* shall have a Class A roof covering or Class A roof assembly according to ASTM E108 or UL 790. For roof coverings where the profile allows a space between the roof covering and roof decking, the space at the eave ends shall be firestopped to preclude entry of flames or embers.

E109.4 Roof coverings subject to hail exposure. Roof coverings used in regions where hail exposure is Moderate or Severe, as determined in accordance with Section E109.4.1 and Figure E108 (1), shall be tested, classified, and labeled in accordance with UL 2218 or FM 4473.

E109.4.1[Add Section Title Here] Hail Exposure regions in Figure E108 (1) shall be as follows:

- **(a) Moderate** - One or more hail days with hail diameters greater than 1.5 in (3 mm) in a twenty (20) year period.
- **(b) Severe** - One or more hail days with hail diameters greater than 2.0 in (50 mm) in a twenty (20) year period.

SECTION E110
STRUCTURAL

E110.1 General. In order to limit the impact of loads from snow, wind, floods and earthquakes on the *building* the *building* shall comply with Sections E110.1 through E110.7 and the requirements for Chapter 4 Special Detailed Requirements Based on Use And Occupancy and Chapter 16 Structural Design of the *International Building Code*.

E110.2 Importance factors by risk category. The minimum design loads for buildings shall be based on the Importance Factors in Table E110 (1).

Table E110(1)
Importance Factors by Risk Category

Risk Category from Table 1604.5 in the IBC	Snow Importance Factor, I_s	Ice Importance Factor, I_i	Wind Importance Factor, I_w	Seismic Importance Factor I_g 0.2 Spectral Response	
				<=0.40 g	>0.40 g
I	0.95	0.95	1.20	1.00	1.20
II	1.20	1.20	1.20	1.00	1.20
III	1.25	1.40	1.15	1.25	1.40
IV	1.30	1.40	1.15	1.50	1.65

E110.3 Snowloads. In order to limit the impact of snow on the *building* the Snow Load Importance Factor, I_S, shall be determined from Table E110 (1).

E110.4 Wind loads. In order to limit the impact of wind on the *building* the Wind Load Importance Factor, I_W, shall be determined from Table E110 (1). Component and cladding loads shall be determined for the design wind speed determined in accordance with Section 1609.1.1 Determination of wind loads of the *International Building Code* and defined assuming terrain Exposure C regardless of the actual local exposure.

E110.5 Flood loads. Buildings designed and constructed in flood hazard areas defined in Section 1612.2 Definitions of the *International Building Code* shall comply with the following.

E110.5.1Floors above base flood elevation. Floors required by ASCE 24 to be built above base flood elevations shall have the floor and their lowest horizontal supporting member not less than the higher of the following:

1. Design flood elevation,
2. Base flood elevation plus 3 feet, or
3. Advisory base flood elevation plus 3 feet, or
4. 500-year flood, if known

E110.5.2 Flood protective works. Buildings designed and constructed in accordance with ASCE 24 shall not consider levees or floodwalls for providing flood protection during the design flood.

E110.5.3 Protection of mechanical, plumbing and electrical systems. Mechanical, plumbing and electrical systems, including plumbing fixtures and utility connections, shall comply with the following:

1. All components shall be elevated above the design *flood* elevation.

   Exception: Electrical systems, equipment and components, and heating, ventilating, air conditioning, and plumbing appliances, plumbing fixtures, duct systems and other service equipment shall be permitted to be located below the design *flood* elevation provided that all elements are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy. Electrical wiring systems shall be permitted to be located below the design flood elevation provided they conform to the provisions of NFPA70.

2. Where break away wall systems are required, vertical runs extending below the lowest habitable floor shall be protected by columns or other structural elements that are not part of any break away wall system and shall not be connected to any break away elements.

E110.6 Earthquake loads. In order to limit the impact of seismic events on the *building* the Seismic Load Importance Factor, I_e, shall be determined from Table E110 (1). The *building* shall also comply with Sections E110.6.1 and E110.6.2.

E110.6.1 Near fault sites. Buildings are not permitted on sites where the ground surface has the known potential to rupture at the structure due to ground motion. Determination shall be based on fault zones (areas subject to severe ground dislocations) that have been established and mapped.

E110.6.2 Seismic Design Categories C, D, E and F. Where the *seismic design category* is determined to be C, D, E or F in accordance with Section 1613.3.5 Determination of seismic design category of the *International Building Code*, the building shall be designed by a *registered design professional*.

E110.7 Atmospheric ice loads. In order to limit the impact of atmospheric ice load events on the *building* the ice- importance factor, I_i, shall be determined from Table E110 (1).

E110.8 Storm Shelters. *Buildings* and structures shall be provided with storm shelters conforming to the requirements of Section 423 of the *International Building Code* where required by Section E110.8.1.

E110.8.1 Storm shelters required. Storm shelters shall be provided for occupants of buildings in accordance with Sections E110.8.1.1, E110.8.1.2 and E110.8.2.3.

Exceptions:

1. *Buildings* meeting the requirements for shelter design in ICC/NSSA 500.
2. Where storm shelters within 1/4-mile of the proposed *building* are available and have adequate size to accommodate the added occupant load of the proposed *building*.
3. Where the code official determines the *building* size, location or occupant load does not warrant shelters.

E110.8.1.1 Hurricane areas. *Buildings* in *hurricane-prone regions* assigned to Group A-3 (community halls, schools and libraries), B (civic administration), E, I-1, I-2, I-3, M, R and buildings assigned to Occupancy Categories III and IV in accordance with Section 1604.5 Risk category of the *International Building Code*.

E110.8.1.2 Tornado areas. *Buildings* assigned to Group A-3 (community halls, schools and libraries), B (civic administration), E, I-1, I-2, I-3, M, R and buildings assigned to Occupancy Categories III and IV in accordance with Section 1604.5 Risk category of the *International Building Code* in areas where the shelter design wind speed for tornadoes of Figure 304.2(1) of ICC/NSSA 500 is 250 mph.

E110.8.1.3 Combined hurricane and tornado shelters. Where combined hurricane and tornado shelters are provided the shelter shall comply with the more stringent requirements of ICC/NSSA-500 for both types of shelters.

E110.9 Wildland. In order to limit the impact of wildland fires on the *building* the *building* shall comply with Sections E110.9.1 through E110.9.3

E110.9.1 Wildland Fires. The provisions of the International Code Council (ICC) *International Wildland-Urban Interface Code* shall apply to the construction, alteration, movement, repair, maintenance and use of any building, structure or premises within the wildland interface areas in this jurisdiction.

E110.9.2 Exterior walls. Exterior wall requirements shall be based on the Fire Hazard Severity specified in Table 502.1 FIRE HAZARD SEVERITY in the International Wildland-Urban Interface Code.

E110.9.3 Smoke Detection. An automatic smoke detection system shall be installed throughout buildings located within areas designated by the jurisdiction as being a wild land urban interface area.

E111
REFERENCED STANDARDS

American Society of Civil Engineers
Structural Engineers Institute

ASCE/SEI
1801 Alexander Bell Drive
Reston, VA 20191-4400

24-13 Flood Resistant Design and Construction

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

ASTM

E108-11	Standard Test Methods for Fire Tests of Roof Coverings
D4226-11	Standard Test Methods for Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products
D5206-13	Standard Test Method for Windload Resistance of Rigid Plastic Siding

Factory Mutual Global Research
Standards Laboratories Department
1301 Atwood Avenue, P.O. Box 7500
Johnston, RI 02919

FM

FM 4473-11	Specification Test Standard for Impact Resistance Testing of Rigid Roof Materials by Impacting With Freezer Ice Balls

International Code Council, Inc.
500 New Jersey Ave, NW
6th Floor
Washington, DC 20001

ICC

IBC – 15	International Building Code®	E102, E103, E104, E105, E106, E107, E108, E109, E110
IECC – 15	International Energy Conservation Code®	
IWUIC – 15	International Wildland-Urban Interface Code®	
ICC 500-14	ICC/NSSA Standard on the Design and Construction of Storm Shelters	

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269

NFPA 13-13	Standard for the Installation of Sprinkler Systems
NFPA 13R-13	Standard for the Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 70-11	National Electrical Code

UL

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062

UL 790-04	Standard Test Methods for Fire Tests of Roof Coverings – with revisions through October 2008

UL 2218-10 Impact Resistance of Prepared Roof Covering Materials

Reason: This reason statement has the following four segments to explain the reasons for this change: (A) Background on these criteria with regard to the ICC code development process; (B) Substantiation for sustainability through enhanced resilience; (C) Additional life safety benefits for occupants through enhanced resilience and (D) General background information identifying the need for enhanced property protection and functional resilience to strengthen the built environment.

(A)

Similar criteria were submitted as proposed mandatory provisions of the 2012 edition of the International Building Code. Committee members identified these types of criteria as having merit but recommended that they be proposed to the International Building Code. Proposals were submitted as mandatory requirements within the body of the International Building Code and also as an optional appendix. Both approached where disapproved for the International Building Code as not being minimum requirements for general construction. Committee members suggested that these types of criteria be addressed in the International Green Construction Code. Thus these criteria are being presented as an optional appendix to the International Green Construction code.

It is noteworthy that state and local jurisdictions are considering criteria for enhanced resilience in their general building code, superseding the criteria of the I-Codes. For example the State of Georgia, under a U.S. Department of Housing and Urban

Development grant and adopted an optional appendix to their statewide code to permit jurisdictions to adopt and enforce criteria for enhanced resiliency. Many jurisdictions like Lake County Illinois have adopted flood criteria that is more stringent the than the criteria in the I-Codes. As jurisdictions are adopting more stringent criteria for all buildings, criteria for enhanced resilience should be a prerequisite for all green or sustainable buildings to provide acceptable levels of longevity, durability, robustness, improved life safety, ease of adaptability for reuse as well as resistance to disasters. Such provisions will reduce time and resources for disaster response and recovery as well as helping to assure community continuity by better maintaining revenues and places for employment and to house employees.

The sustainability benefits of enhanced resiliency in building design and construction are not limited to the general continuity and welfare of communities but also have a significant role to minimize negative environmental impacts should disasters occur. The U.S. Army Corps of engineers reported that 44 million cubic yard of building materials and contents were disposed of in land following Hurricane Katrina. Most of the materials were not salvageable because they were contaminated. This is the equivalent of laying 21 cubic foot refrigerators end to end twice around the equator. Provisions for enhanced resiliency such as elevating habitable spaces above a specific natural flood elevation can significantly minimize the amount of materials disposed because they are damaged and contaminated. Reports after the tornado strike in Moore, Oklahoma advised that is placed on a single debris pile the pile of debris would have been more than a mile high. More resilient construction would clearly minimize the amount of damage, may not from a direct path of the funnel of an EF5 tornado, but at least for the lower perimeter wind forces and flying debris.

(B)

The following are reports of dollar loss to property from wind, cold weather and fire disasters.

- The American Society of Civil Engineers reported in *Normalized Hurricane Damage in the United States, 1900 – 2005,* National Hazard Review, ASCE 2008, that property damage from hurricanes was 81 billion dollars in 2005.

- The National Weather Service reports that U.S. property damage due to winter storms and ice exceeded 1.5 billion dollars in 2009.

- *Fire Losses in the United States During 2009* by the National Fire Protection Association, August 2010 shows that property loss due to structure fires in buildings other than one and two family dwellings was approximately 4.5 billion dollars.

Increasing the stringency of the design criteria of buildings for hazards such as wind, snow or fire results in more robust buildings. Such requirements reduce the amount of energy and resources required for repair, removal, disposal and replacement of building components and systems damaged from these disasters. A further benefit is a reduction in the amount of damaged building materials and content entering landfills.

While there has not been a proportionate increase in either frequency of events (which have remained relatively constant) construction put in place (which has maintained an upward trend of trend of 10% per decade or 40% over last four decades) or demographics (population growth even in the fastest growing regions has 10% per decade or 40% over the same time period) property losses due to natural disasters, adjusted to 2010 dollars, have increased by over a staggering 3500%, see Figure 1. Losses from fire, adjusted to 2010 dollars, have increased by 85% per fire, see Figure 2.

Figure 1 Increase in Property Losses Due to Natural Disasters, excluding Flood[1]

Flood losses not collected by private insurance companies

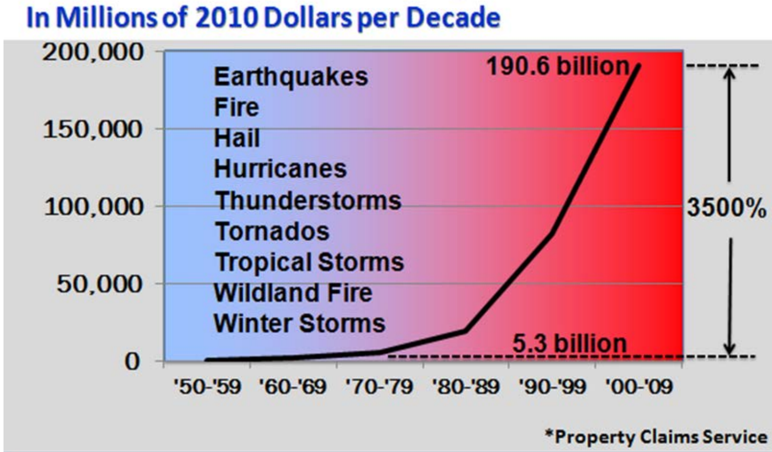
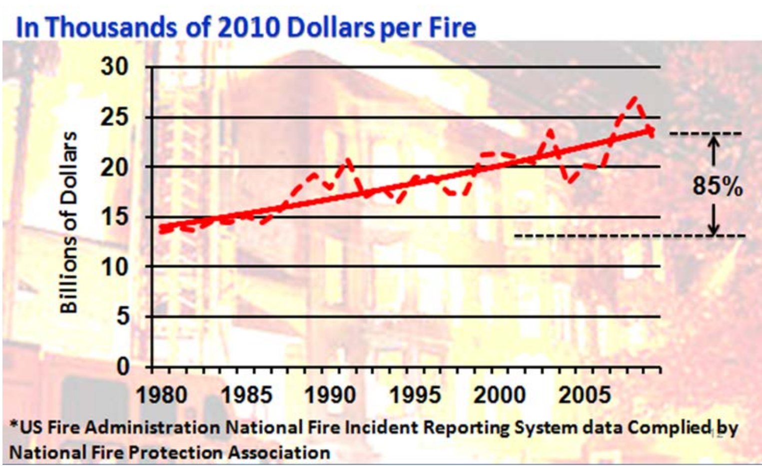


Figure 2 Increase in Fire Losses Per Structure Fire



These specific requirements help reduce commonly occurring property losses.

Flooding:

Hurricanes:

Source: U.S. Navy photo by
Chief Petty Officer Johnny Bivera
Katrina Aftermath
Seismic Events:

SourceFederal Emergency Management Agency

Earthquake damage to personal property.

Snow loads:

Source – Institute for Business and Home Safety

In many instances roof collapse due to snow loads not only results in damage to roof and building contents below but may also remove lateral support, allowing walls to collapse.

Wind:

Source: Federal Emergency Management Agency, photograph taken by Lara Shane of FEMA.

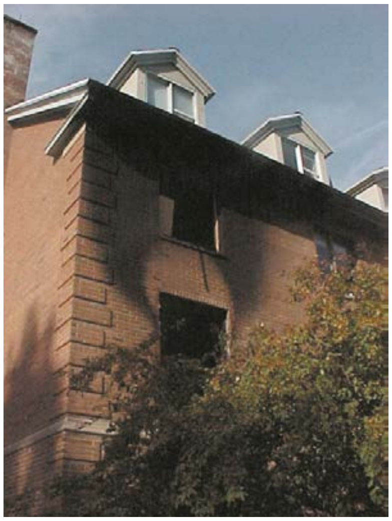
Homes and businesses that are not designed and constructed to provide an appropriate level of resilience are at greater risk in high wind exposures.

Tornadoes:

Source: Oklahoma Department of Emergency Management

Storm shelters and safe rooms really work

Structure Fires:



Source: Northeast Fire Safety Construction Advisory Council

Fire containment achieved with compartmentation minimizes damage due to fire, smoke and water used for suppression.

External fire Exposure:

Source: Brick Institute of America Region 9.

Siding on a building nearly 100 feet away from a burning building needs to be replaced.

Wildland Fires and Conflagrations after Disasters:

Source: Federal Emergency Management Agency

Topography, vegetative fuels and drought contribute to the potential for devastating wildfires

Wind Damage – Attachment

Source – Portland Cement Association – photo by Steve Skalko

Damage to siding and sheathing as a result of high winds

Wind Damage - System Failure

Source – Institute for Business & Home Safety

Wind damage to lightweight exterior wall covering.

Hail impact: Horizontal Surfaces

Source: National Oceanic and Atmospheric Administration, National Weather Service.

Roof shingles need to be removed, disposed and replaced due to hail damage

Hail Impact: Vertical Surfaces

Source National Oceanic and Atmospheric Administration, National Weather Service

Siding needs to be removed, disposed and replaced due to hail damage.

Rodentproofing:

Source: Image provided with permission from Alternative Building Services: www.altbuildingservices.com.

Building elements in need of repair due to rodent damage. Undetected damage can compromise the integrity of the building thermal envelope and moisture protection.

Further benefits are enhanced security and occupant comfort; potentially less demand on community resources required for emergency response; and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

(C)

The 1987 landmark report "America Burning" (Report of the National Commission on Fire Prevention and Control) recommended the increased use of automatic sprinkler systems, and the sprinkler trade-off concept as a financial incentive to encourage the installation of sprinklers in buildings to enhance life safety to the benefit of the building occupants. Automatic fire sprinklers designed for the intended fire load that are installed correctly and maintained to operate with adequate water supply are undoubtedly have contributed significantly to reduced loss of life and reduced property damage. However, for the last two decades hundreds of sprinkler trade-offs have been incorporated into model building codes such as the International Building Code that drastically reduce built-in fire protection when sprinklers are present. The result is considerably less fire safety layers in a building and significant reliance only on the sprinkler system for occupant safety.

There is increasing concern about the reduction or complete elimination of fire rated assemblies based on reliance of automatic sprinklers. To address this concern this proposal removes many of the sprinkler trade-offs in order to encourage increase fire safety and resilience of buildings through a combination of fire resistant construction and sprinklers protection.

Too, natural disasters such earthquakes, hurricanes and floods disrupt water supplies and power to buildings adversely affecting the life safety systems such as sprinkler protection and fire alarm systems. These events also damage gas mains serving buildings resulting in gas leaks and increased fire incidents. Without the fire safety layers of sprinklers and fire alarms, the building will not be able to withstand as big of a fire and will fail sooner, putting occupants and especially firefighters at great risk. This proposal encourages enhanced resilience to these natural disasters to reduce fire safety risk to the occupants.

It has been widely accepted that when buildings are constructed with an appropriate combination of active and passive fire protection using the concept of fire safety layering, they are more resilient and better able to ensure continuity of operations, improved sustainability, increased durability, increased adaptability for reuse, increased resistance to disasters, and improved life safety for occupants and firefighters.

(D)

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal attempts to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the International Building Code as a non-mandatory Appendix. This allows adopting jurisdictions the option of incorporating code requirements into the building code to improve the resilience of the built environment without the need to add another code to the community requirements.

The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience for resource minimization are integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts are:

Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities

National Institute of Building Sciences Multi-Hazard Mitigation Council - 2005

One of the findings in this report is "The analysis of the statistically representative sample of FEMA grants awarded during the study period indicates that a dollar spent on disaster mitigation saves society an average of $4." The programs studied often addressed issues and strategies other than enhanced disaster resistance of buildings and other structures. However, more disaster-resistant buildings enhance life safety; reduce costs and environmental impacts associated with repair, removal, disposal, and replacement; and reduce the time and resources required for community recovery.

2. Five Years Later – Are we better prepared?

Institute for Business and Home Safety - 2010

This IBHS report states: "When Hurricane Katrina made landfall on Aug. 29, 2005, it caused an estimated $41.1 billion in insured losses across six states, and took an incalculable economic and social toll on many communities. Five years later, the recovery continues and some residents in the most severely affected states of Alabama, Louisiana and Mississippi are still struggling. There is no question that no one wants a repeat performance of this devastating event that left at least 1,300 people dead. Yet, the steps taken to improve the quality of the building stock, whether through rebuilding or new construction, call into question the commitment of some key stakeholders to ensuring that past mistakes are not repeated." This report indicates that there is a need to implement provisions to make buildings more disaster-resistant. Clearly this suggests that functional resilience should at least be integrated into the design and construction of sustainable buildings.

3. National Weather Service Office of Climate, Water and Weather Services

National Oceanic and Atmospheric Administration (NOAA) - 2010

Data provided on the NOAA website [www.weather.gov/os/hazstats.shtml] indicates that the average annual direct property loss due to natural disasters in the United States exceeds of $35,000,000,000. This does not include indirect costs associated with loss of residences, business closures, and resources expended for emergency response and management. These direct property losses also do not reflect the direct environmental impact due to reconstruction after the disasters. Functional resilience will help alleviate the environmental impact and minimize both direct and indirect losses from natural disasters.

4. Global Climate Change Impacts in the United States

U.S. Global Change Research Program (USGCRP) - 2009

The USGCRP includes the departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Interior, State and Transportation; National Aeronautic and Space Administration; Environmental Protection Agency, USA International Development, National Science Foundation and Smithsonian Institution

The report identifies that: "Climate changes are underway in the United States and are projected to grow. Climate-related changes are already observed in the United States and its coastal waters. These include increases in heavy downpours, rising temperature and sea level, rapidly retreating glaciers, thawing permafrost, lengthening growing seasons, lengthening ice-free seasons in the ocean and on lakes and rivers, earlier snowmelt, and alterations in river flows. These changes are projected to grow." The report further identifies that the: "Threats to human health will increase. Health impacts of climate change are related to heat stress, waterborne diseases, poor air quality, extreme weather events, and diseases transmitted by insects and rodents. Robust public health infrastructure can reduce the potential for negative impacts." Key messages in the report on societal impacts include:

- City residents and city infrastructure have unique vulnerabilities to climate change. "
- Climate change affects communities through changes in climate- sensitive resources that occur both locally and at great distances."
- Insurance is one of the industries particularly vulnerable to increasing extreme weather events such as severe storms, but it can also help society manage the risks."

Sustainable building design and construction cannot be about protecting the natural environment without consideration of the projected growth in severe weather. Minimum codes primarily based on past natural events are not appropriate for truly sustainable buildings. Buildings expected to have long term positive impacts on the environment must be protected from these extreme changes in the natural environment. The provisions for improved property protections are necessary to reduce the amount of energy and resources associated with repair, removal, disposal, and replacement due to routine maintenance and damage from disasters. Further such provisions reduce the time and resources required for community disaster recovery.

5. ***Sustainable Stewardship -*** *Historic preservation plays an essential role in fighting climate change ,*

Traditional Building, National Trust for Historic Preservation - 2008

In the article Richard Moe summarizes the results of a study by the Brookings Institution which projects that by 2030 we will have demolished and replaced 82 billion square feet of our current building stock, or nearly 1/3 of our existing buildings, largely because the vast majority of them weren't designed and built to last any longer. Durability, as a component of functional resilience, can reduce these losses.

6. Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs

Senate Environment and Public Works Committee Room, Dirksen Senate Office Building, Washington, D.C. - 2010

During this panel discussion a representative of the National Conference of State Historic Preservation Officers noted that more robust buildings erected prior to 1950 tend to be more adaptable for reuse and renovation. Prior to the mid-1950s most local jurisdictions developed their own building code requirements that uniquely addressed the community's needs, issues and concerns. Pre-1950 building codes typically resulted in more durable and robust construction that lasts longer.

The total environmental impact of insulation, high efficiency equipment, components, and appliances, low-flow plumbing fixtures, and other building materials and contents are relatively insignificant when rendered irreparable or contaminated and must be disposed of in landfills after disasters. The US Army Corps of Engineers estimated that after Hurricane Katrina nearly 1.2 billion cubic feet of building materials and contents ended up in landfills. This is analogous to stacking enough refrigerators a fifth of the way to the moon or placing them end to end around the equator of the Earth twice.

Cost Impact: Will increase the cost of construction

GG338-14 : APPENDIX E (NEW)-SKALKO909
