Code Technology Committee

Area of Study – NIST World Trade Center Recommendations

2007/2008 Cycle
Code changes related to the CTC area of study noted above

FILE 2 OF 2

The following are code changes related to the CTC NIST World Trade Center Recommendations Area of Study that will be considered at the 2007/2008 Code Development Hearings in Palm Springs, California. **Note that this is File 2 of 2 and includes IBC - Fire safety, General and Egress. File 1 includes IBC – Structural and IFC.**

FS7–07/08
703.2.4 (New), Chapter 35 (New)

Proponent: Jason Thompson, PE, National Concrete Masonry Association (NCMA), representing Masonry Alliance for Codes and Standards (MACS)

1. Add new text as follows:

703.2.4 Impact resistance. Fire-resistance rated wall assemblies required to have a fire-resistance rating of not less than 2 hours shall be tested in accordance with ASTM F2322 to achieve a Grade No. 4 or better.

2. Add standard to Chapter 35 as follows:

ASTM

F 2322-03 Standard Test Methods for Physical Assault on Vertical Fixed Barriers for Detention and Correctional Facilities

Reason: The purpose of this code change proposal is to require fire-resistance rated wall assemblies required by other provisions of the code to have not less than a 2-hour fire-resistance rating to be able to withstand a substantial physical impact. If such walls can withstand the prescribed impact based on ASTM F2332, then there is a very high probability that they will be in place and structurally intact in order to perform their intended function should an uncontrolled post flashover fire occur. A significant impact test should result in walls where maintenance and repairs would be minimal. So there would be less chance of the wall being "violated" when a fire occurs. In other words, the wall would be durable enough to function as intended for the life of the building while needing minimum maintenance to maintain the wall's integrity and fire-resistance rating.

The threshold of a minimum 2-hour fire-resistance rating for such walls was chosen because those walls are of fairly substantive construction and generally perform more critical functions than lesser fire-resistance rated walls. And they are intended to withstand a major fire exposure for a significant amount of time. Furthermore, in many applications it is likely that the 2-hour fire-resistance rated walls will be in buildings that are not protected throughout with an automatic sprinkler system. Thus, they have a greater potential for being exposed to an uncontrolled post-flashover fire for a long fire exposure period at very elevated temperatures. Of course, during such a fire there are many dynamic conditions which occur that may have an adverse impact on these walls. Falling ceilings, collapsing file cabinets and other furniture and furnishings, shifts in the structural supports for the walls as the elements expand from the fire exposure, and thermal stresses within the walls themselves may cause the walls to fail prematurely.

These walls are generally required to perform one or more of the following critical fire/life safety functions during an uncontrolled post flashover fire:

Fire containment
Life safety protection
Property protection
Structural integrity
Restrict smoke spread

A review of the International Building Code (IBC) indicates that the following code provisions would require a minimum 2-hour fire-resistance rating for walls under the conditions prescribed:

Separation of incidental accessory occupancies including incinerator rooms, paint shops, hydrogen cut-off rooms, and parking garages   Table 508.2.5
Occupancy separations in nonsprinklered buildings and for all Group H occupancies   Table 508.4
Exterior bearing walls in Types I, III, and IV construction   Table 601
Interior bearing walls in Type I construction   Table 601
Exterior walls having a fire separation distance less than 5 feet for buildings containing Group F-1, M, S-1, and H occupancies   Table 602
Fire walls   Table 705.4
Fire area separations   Table 706.3.9
Shaft enclosures connecting 4 or more stories   Section 707.4
Smokeproof enclosures   Section 909.20.2
Exit stair enclosures connecting 4 or more stories   Section 1020.1
Horizontal exits   Section 1022.2

Obviously, fire walls are critically important since they create separate buildings. So they must be structurally independent and remain standing even after collapse of the construction on either side which may be caused by a total burnout.

Exit stairway enclosures and elevator hoistway enclosures are essential for life safety as recognized in the NIST WTC Report Recommendation 18 in Chapter 9. It recommends that egress systems including stairs, elevators, and exits be designed to maintain their functional integrity and survivability under foreseeable building specific or large scale emergencies. The design, functional integrity and survivability of the egress and other life safety systems such as stairwells and elevator shafts should be enhanced by considering accidental structural loads such as those induced by overpressures, impacts, or major hurricanes and earthquakes, in addition to fire separation requirements. The stairwells and elevator shafts should have adequate structural integrity to withstand accidental structural loads and anticipated risks. This is a concept known as hardening of the shaft enclosures to assure that their structural integrity will be intact under very adverse fire conditions.

Smokeproof enclosures would also fall under the same category as exit stairway enclosures. But they are even more critical since they are required in high-rise buildings. Obviously, they also serve as a critical exit element in those buildings.

Other shaft enclosures are intended to protect against vertical fire and smoke spread in buildings 4 or more stories in height. This is a very important function in order to prevent a fire from involving multiple stories at the same time. The integrity of shaft enclosures is essential to providing adequate fire and life safety protection to these multistory buildings.

Interior bearing walls in buildings of Type I construction are critically important since these buildings are generally either very large in area and/or are high-rise buildings. The interior bearing walls act similarly to the structural frame and are even required to have the same fire-resistance ratings as the structural frame in accordance with Table 601. They are just as essential to the overall structural integrity of the building as the structural frame.

Horizontal exits perform a similar function to an exit stairway enclosure by providing refuge areas for people to evacuate into from the fire side of the horizontal exit. So they should obviously perform comparably to exit stairway enclosures in order to serve their intended function of protection in place, especially during a severe fire condition.

Exterior bearing walls in Types I, III, and IV construction are intended to be of substantial construction in order to protect against conflagrations. They must maintain their structural integrity to not only contain a total burnout in the building, but to also resist an exterior exposure fire while not collapsing. Certainly, exterior bearing walls are essential to the overall structural integrity of the building which are critically important for Type I construction as discussed above for interior bearing walls in Type I construction.

Exterior walls with a fire separation distance of less than 5 feet are required to have a minimum 2-hour fire-resistance rating for buildings containing Groups F-1, H, M, and S-1 occupancies. These are the higher fire load occupancies which require substantial protection to avoid building-to-building fire spread either from an adjacent building or from the building itself to adjacent buildings. In these cases where the fire separation distance is less than 5 feet, flames from an adjacent building can actually contact the exterior walls of the exposed buildings. Furthermore, unprotected openings are not permitted in nonsprinklered buildings with a fire separation distance less than 5 feet in order to further minimize the potential for building-to-building fire spread. So these walls need to maintain their integrity in order to stay in place for the duration of the fire as required by Section 704.6 Structural Stability.

Fire area separations are used to compartment a building so as not to exceed the thresholds for requiring an automatic sprinkler system. Thus, they are used to subdivide nonsprinklered buildings into manageable compartment sizes that the fire department can suppress within the boundaries of the compartment. The purpose of these walls is to prevent the fire from breaking out and spreading to adjacent compartments (fire areas) before the fire department can contain and control the fire. Under those conditions, it is very important that these fire area separation walls maintain their durability and integrity to assure their fire-resistance performance.

In general, occupancy separations are only required to have 2-hour or greater fire-resistance ratings in nonsprinklered buildings, as well as for all Group H occupancies. Occupancy separations are provided when the occupancy separation option in Section 508 is used. So it is important to assure that the occupancy separation walls will function as intended to prevent fire spread to the adjacent occupancies so separated. That is because in most cases these are very life safety sensitive occupancy separations involving Groups A, E, I, and R occupancies.

The incidental accessory occupancies requiring separation from any occupancy in which they are located by a minimum 2-hour fire-resistance rated wall are generally those occupancies that have a significantly higher fire load or potential fire exposure or pose an unusual life safety hazard to the main occupancy which may also be life safety sensitive.

We decided to utilize the ASTM F2332 Standard Test Methods for Physical Assault on Vertical Fixed Barriers for Detention and Correctional Facilities because it is a nationally recognized consensus standard that provides some measure or assessment of significant impact resistance. We have chosen to utilize the lowest category of impact resistance which is designated as Grade No. 4. It requires the wall to resist 100 impacts consisting of 50 impacts by a blunt impactor and 50 impacts by a sharp impactor. The impacting force is 200 foot-pounds for the blunt impactor and 100 foot-pounds for the sharp impactor. The Grade No. 4 performance level gives an indication that the wall may be able to withstand an assault with similar type devices such as a sledge hammer or a fireman's axe for a period of 10 minutes. Failure of the wall to resist the 100 impacts prescribed occurs if a hole is created through the entire wall which would allow a 5 in x 8 in x 8 in rigid box to pass through the wall using a 10 pound force to push it through the breach.

In conclusion, we believe that the requirement for an impact test such as ASTM F2322 will help to assure a reasonable degree of durability and dependability for fire-resistance rated wall assemblies required to have a minimum 2-hour fire-resistance rating. This will help to assure that they will be intact and in place to perform their intended functions during an uncontrolled post-flashover fire condition. Since the ASTM E119 Fire-Resistance Test does not have a comparable test for determining the physical integrity and resistance to impact of walls under non-fire conditions, this code change proposal should provide for a means to measure that performance and complement the fire testing criteria for fire-resistance in ASTM E119.

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, ASTM F 2322, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.

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FS113–07/08
714.1.1

Proponent: Maureen Traxler, City of Seattle, WA, representing Washington Association of Building Officials Technical Code Development Committee

Revise as follows:

714.1.1 (Supp) Primary structural frame. The primary structural frame ~~shall be~~ is the columns and other structural members including the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. Bracing members that are essential to the vertical stability of the primary structural frame under gravity loading shall be considered part of the primary structural frame whether or not the bracing member carries gravity loads.

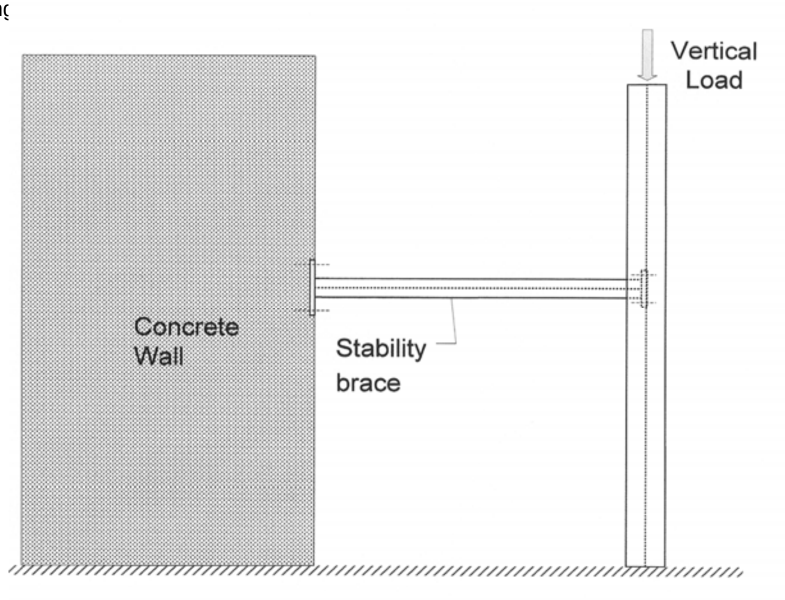
Reason: The purpose of this code change is to clarify the code provisions regarding what portions of the structure should be considered "primary structural frame", and therefore, require a fire-resistive rating.

The current language is clear in its intent that bracing members that carry only lateral loads (wind or earthquake) are not required to have a fire-resistive rating. Bracing members that carry vertical (gravity) loads as well as lateral loads are required to have a fire-resistive rating. However, the code is silent on bracing members that contribute to the overall stability of the building under gravity loading, but do not directly carry gravity loads.

The figure below illustrates an example where a brace is used to shorten the effective length of a column, preventing the column from buckling under gravity loads. The brace is not directly carrying gravity loads, but under full design loads, if it were not there, the column would fail (assuming the members are designed to the minimum size allowed). In a fire, the brace could be subjected to the same fire conditions as the column. Yet, under the current language in the code, there is no requirement to protect it. So if the fire causes the brace to fail, regardless of what fire-resistive rating is required for the column, the column will also fail.

The proposed language addresses this issue by including these types of braces in the definition of "primary structural frame". Logically, if the column is required to have a fire-resistance rating, in order for the column to perform as expected, the brace should be protected to the same degree.

Cost Impact: The code chang



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FS114–07/08

Table 601, 704.8.1, 714.1.1, 714.1.2, 714.2, 714.6, 1704.10.5.2

Proponent: Maureen Traxler, City of Seattle, WA, representing Washington Association of Building Officials Technical Code Development Committee

THESE PROPOSALS ARE ON THE AGENDA OF THE IBC GENERAL AND THE IBC FIRE SAFETY CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IBC GENERAL

Revise as follows:

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Primary structural frame[g] See Section ~~714.1.1~~ 202	3[a]	2[a]	1	0	1	0	HT	1	0

~~Including columns, girders, trusses~~									

(Portions of table not shown remain unchanged)

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall 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-treated wood members shall be allowed to be used for such unprotected members.
c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.
d. An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be allowed to be substituted for 1-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of the code or used for an allowable area increase in accordance with Section 506.3 or an allowable height increase in accordance with Section 504.2. The 1-hour substitution for the fire resistance of exterior walls shall not be permitted.
e. Not less than the fire-resistance rating required by other sections of this code.
f. Not less than the fire-resistance rating based on fire separation distance (see Table 602).
g. Not less than the fire-resistance rating as referenced in Section 714.5

PART II – IBC FIRE SAFETY

Revise as follows:

~~714.1.1~~ 202 Primary structural frame. ~~The primary structural frame shall be~~ The columns and other structural members including the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof construction that are not connected to the columns are not part of the primary structural frame.

~~**714.1.2 Secondary members.** The members of floor or roof construction that are not connected to the columns shall be considered secondary members and not part of the primary structural frame.~~

714.2 Individual encasement protection. ~~Girders, trusses, beams, lintels or other~~ Structural members that are required to have a fire-resistance rating and that support more than two floors or one floor and roof, or support a load-bearing wall or a nonload-bearing wall more than two stories high, shall be individually protected on all sides for the full length, including connections to other structural members, with materials having the required fire-resistance rating.

704.8.1 Allowable area of openings. The maximum area of unprotected and protected openings permitted in an exterior wall in any story of a building shall not exceed the percentages specified in Table 704.8.

1. In other than Group H occupancies, unlimited unprotected openings are permitted in the first story above grade either:
    1.1. Where the wall faces a street and has a fire separation distance of more than 15 feet (4572 mm); or
    1.2. Where the wall faces an unoccupied space. The unoccupied space shall be on the same lot or dedicated for public use, shall not be less than 30 feet (9144 mm) in width, and shall have access from a street by a posted fire lane in accordance with the *International Fire Code*.
2. Buildings whose exterior bearing walls, exterior nonbearing walls and exterior primary structural frame are not required to be fire-resistance rated shall be permitted to have unlimited unprotected openings.

1704.10.6.2 (Supp) Structural frame members. The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of primary structural frame member for each 2,500 square feet (232 m^2) of floor area or portion thereof in each story.

Reason: This proposal completes the change begun by FS98-06/07 which responded to the NIST WTC recommendations by enhancing the IBC provisions related to structural frame. This proposal distributes the term "primary structural frame" in appropriate places throughout the code and makes several other changes.

Table 601. The language deleted from the first row of Table 601 is misleading because it is only a portion of the definition of structural frame. The code user is given an incorrect impression that the structural frame consists of only the columns, girders and trusses when, according to the definition, it includes all members with direct connections to the columns, and all bracing members designed to carry gravity loads.

Definition of "primary structural frame". The term "primary structural frame" is used in other portions of the code, including Chapters 6 and 7, so definition should be located where it's accessible for those chapters. The substance of this definition is added to the definition of "primary structural frame".

Definition of "secondary structural frame". The term "secondary members" is deleted because it isn't used. Members that aren't primary structural frame are simply structural frame or structural members.

Section 714.2. The list of types of structural members is deleted from Section 714.2 to eliminate confusion and unnecessary language. Table 601 either requires all structural members to be protected, or none. Protection is never required for only some of them, so there is no need to have a list of members—the definition of primary structural frame has a more complete description of the term.

Other sections. The word "primary" is added to other sections where use of the defined term is appropriate. A list of the sections in which the terms "structural frame" and "structural framing" are used is shown for reference.

Term "structural frame" is used:	Term "structural framing" is used:
704.8.1 #2 (2007 supplement) Table 601 714.6 2104.2.1 2109.4.3 2109.7.4 3402 H109.1	410 definition of "gridiron" 1704.10.3.2 1704.10.5.2 2109.7.4

Cost Impact: The code change proposal will not increase the cost of construction.

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FS115–07/08

Table 601, 704.8.1, 714.1, 714.1.1, 714.1.2, 714.4, 714.2, 714.2.1, 714.3, 714.6

Proponent: Philip Brazil, PE, Reid Middleton, Inc., representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IBC FIRE SAFETY AND THE IBC GENERAL CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IBC FIRE SAFETY

Revise as follows:

704.8.1 (Supp) Allowable area of openings. The maximum area of unprotected and protected openings permitted in an exterior wall in any story of a building shall not exceed the percentages specified in Table 704.8.

Exceptions:

1. In other than Group H occupancies, unlimited unprotected openings are permitted in the first story above grade either:
   1.1. Where the wall faces a street and has a fire separation distance of more than 15 feet (4572 mm); or
   1.2. Where the wall faces an unoccupied space. The unoccupied space shall be on the same lot or dedicated for public use, shall not be less than 30 feet (9144 mm) in width, and shall have access from a street by a posted fire lane in accordance with the *International Fire Code*.
2. Buildings whose exterior bearing walls, exterior nonbearing walls and exterior primary structural frame are not required to be fire-resistance rated shall be permitted to have unlimited unprotected openings.

714.1 (Supp) Requirements. The fire-resistance ratings of structural members ~~and assemblies~~ shall comply with this section and the requirements for the type of construction as specified in Table 601 ~~and~~. The fire-resistance ratings shall not be less than the ratings required for the fire-resistance-rated assemblies supported by the structural members.

Exception: Fire barriers, fire partitions, smoke barriers and horizontal assemblies as provided in Sections 706.5, 708.4, 709.4 and 711.4, respectively.

714.1.1 (Supp) Primary structural frame. The primary structural frame shall ~~be~~ include all of the following structural members:

1. The columns ~~and other~~ ;
2. Structural members ~~including the girders, beams, trusses and spandrels~~ having direct connections to the columns, including girders, beams, trusses and spandels;
3. Members of the floor construction and roof construction having direct connections to the columns; and
4. Bracing members designed to carry gravity loads.

~~714.2~~ 714.1.2 (Supp) Secondary members. The following structural members ~~of floor or roof construction that are not connected to the columns~~ shall be considered secondary members and not part of the primary structural frame:

1. Structural members not having direct connections to the columns;
2. Members of the floor construction not having direct connections to the columns; and
3. Bracing members not designed to carry gravity loads.

~~714.4~~ 714.2 (Supp) Column protection. Where columns are required to be fire-resistance rated, the entire column, ~~including its connections to beams or girders,~~ shall be provided individual encasement protection by protecting it on all sides for the full column length, including connections to other structural members, with materials having the required fire-resistance rating. Where the column extends through a ceiling, the ~~fire resistance rating of the column~~ encasement protection shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.

~~714.2~~ 714.3 (Supp) ~~Individual encasement protection~~ Protection of the primary structural frame other than columns. ~~Girders, trusses, beams, lintels or other structural~~ Members of the primary structural frame other than columns that are required to have a fire-resistance rating and ~~that~~ support more than two floors or one floor and roof, or support a load-bearing wall or a nonload-bearing wall more than two stories high, shall be ~~individually protected~~ provided individual encasement protection by protecting them on all sides for ~~the~~ their full length, including connections to other structural members, with materials having the required fire resistance rating.

> **Exception:** Individual encasement protection on all sides shall be permitted on all exposed sides provided the extent of protection is in accordance with the required fire-resistance rating, as determined in Section 703.

~~714.2.1~~ 714.4 (Supp) ~~Alternative~~ Protection of secondary members. ~~The structural~~ Secondary members that are required to have a fire-resistance rating ~~and are not required to be provided individual encasement protection according to Section 714.2~~ shall be protected by individual encasement protection, by ~~a~~ the membrane or ceiling ~~protection as specified in~~ of a horizontal assembly in accordance with Section 711, or by a combination of both.

~~714.3~~ 714.4.1 (Supp) ~~Membrane protection~~ Light-frame construction. King studs and boundary elements that are integral elements in load-bearing walls of light-frame~~d~~ construction shall be permitted to have required fire-resistance ratings provided by the membrane protection provided for the load-bearing wall.

(Renumber Sections 714.2.3-714.2.5 as Sections 714.5-714.7, and Sections 714.3-714.5 as Sections 714.8-714.10)

~~714.6~~ 714.11 Bottom flange protection. Fire protection is not required at the bottom flange of lintels, shelf angles and plates, spanning not more than 6 feet (1829 mm) whether part of the primary structural frame or not, and from the bottom flange of lintels, shelf angles and plates not part of the primary structural frame, regardless of span.

(Renumber subsequent sections)

PART II – IBC GENERAL

Revise table as follows:

TABLE 601 (Supp)
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
BUILDING ELEMENT	**A**	**B**	**A [d]**	**B**	**A [d]**	**B**	**HT**	**A [d]**	**B**
Primary structural frame [g] See Section 714.1.1 ~~Including columns, girders, trusses~~	3[a]	2[a]	1	0	1	0	HT	1	0
Bearing walls Exterior [f, g] Interior	 3 3[a]	 2 2[a]	 1 1	 0 0	 2 1	 2 0	 2 1/HT	 1 1	 0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior [e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and secondary members See Sections 714.1.1 and 714.1.2 ~~Including supporting beams and joists~~	2	2	1	0	1	0	HT	1	0
Roof construction and secondary members See Sections 714.1.1 and 714.1.2 ~~Including supporting beams and joists~~	1-½[b]	1[b, c]	1[b, c]	0[b, c]	1[b, c]	0[b, c]	HT	1[b, c]	0

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.

b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall 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-treated wood members shall be allowed to be used for such unprotected members.

c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.

d. An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be allowed to be substituted for 1-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of the code or used for an allowable area increase in accordance with Section 506.3 or an allowable height increase in accordance with Section 504.2. The 1-hour substitution for the fire resistance of exterior walls shall not be permitted.

e. Not less than the fire-resistance rating required by other sections of this code.

f. Not less than the fire-resistance rating based on fire separation distance (see Table 602).

g. Not less than the fire-resistance rating as referenced in Section 714.5

Reason: The purpose for this proposal is to make the provisions approved by Proposal FS98-06/07-AS more technically sound and to improve coordination with other provisions of the IBC. Reference to “columns, girders and trusses” in the item under “Building Element” for primary structural frame” in Table 601 is deleted because it is effectively replaced by the reference to Section 714.1.1 and conflicts with the references in Section 714.1.1 to columns, girders, beams, trusses and spandrels.

In Section 714.1, “and assemblies” is deleted because the subject of Section 714.1 is structural members, not assemblies, which implies floor, roof or wall assemblies. The other revisions are editorial. Note that “structural member” is not currently defined in the IBC.

The revision to Section 714.1.1 may appear editorial but it is being done to make it clear which components of the structure are part of the primary structural frame. The current language implies that, in addition to columns and bracing members designed to carry gravity loads, only girders, beams, trusses and spandrels having direct connections to the columns are part of the primary structural frame. The intent, however, is that, in addition to columns, all structural members having direct connections to the columns, including structural members of the floor construction and roof construction and bracing members that are designed to carry gravity loads, are part of the primary structural frame. The listing of girders, beams, trusses and spandrels in Section 714.1.1 should be viewed as examples of such structural members.

Section 714.1.1 is also revised to specify all members of the primary structural frame as structural members. This revision makes it clear that bracing members are structural members and reduces questions over the scope of Section 714.1, which specifies structural members but not bracing members. Structural members of the floor construction and roof construction having direct connections to the columns are also identified as members of the primary structural frame. This revision correlates Section 714.1.1 with Section 714.1.2 on secondary members, which specifies members of the floor construction and roof construction not connected to columns.

Section 714.1.2 is revised because the current language does not make it clear whether structural members not having direction connections to the columns and bracing members not designed to carry gravity loads are members of the floor or roof construction such that they are considered secondary members. The current language also creates a gap between what structural members are considered part of the primary structural frame and what are considered secondary members. This gap consists of a third group of structural members that are neither part of the primary structural frame nor secondary members. Section 714.1.2 is revised to close this gap by clearly specifying what structural members are secondary members, including structural members not having direct connections to the columns as structural members and bracing members not designed to carry gravity loads.

Also in Section 714.1.2, members of the floor or roof construction “not connected” to the columns is changed to “not having direct connections" to the columns to make it clear that structural members indirectly connected via supporting beams or girders that are directly connected to the columns are not intended to be members of the primary structural frame. Note that horizontal bracing members typically are part of the floor or roof construction. The format of Section 714.1.2 is revised to specify individual items in the same manner as Section 714.1.1.

In conjunction with the proposed changes to Section 714.1.2, secondary members are added to the listings of floor construction and roof construction in Table 601 along with references to Sections 714.1.1 and 714.1.2 in the same manner as the listing for primary structural frame. With the approval of FS98-06/07, secondary members become a distinct type of building element and should be specified in Table 601 along with primary structural frame.

The order of the technical provisions in Section 714 is revised. The primary structural frame consists of the columns with the most restrictive technical provisions (Section 714.4), other members of the primary structural frame with technical provisions that are less restrictive than columns (Section 714.3), and secondary members with technical provisions that are less restrictive than the primary structural frame (Section 714.2.1). These sections are rearranged beginning with the most restrictive: columns in Section 714.2, primary structural frame members other than columns in Section 714.3 and secondary members in Section 714.4.

References to individual encasement protection are clarified. Renumbered Sections 714.2 and 714.3 (current Sections 714.4 and 714.2) reference individual encasement protection but neither section contains technical provisions for it. Also, the title of renumbered Section 714.3 is "individual encasement protection" but the provisions in the section do not mention it. Instead, individual protection on all sides of the structural member for its full length, including connections to other structural members, is specified. If individual encasement protection is the intent, it is not achieved by reliance on the title of the section, which is nonmandatory. Renumbered Sections 714.2 and 714.3 are revised by specifying individual encasement protection as individual protection on all sides of the structural member for its full length, including connections to other structural members, with materials having the required fire-resistance rating.

An exception is added to renumbered Section 714.3 (current Section 714.2) on primary structural frame members other than columns. Beams and girders typically support floor or roof construction, which prevents the protection of their surfaces that bear against floor or roof members (i.e., steel decks). The exception permits the protection on all sides to be only on exposed sides provided the assembly being relied on for the required fire resistance rating limits protection to the exposed sides.

"Structural frame" in Item (a) of Table 601, Section 704.8.1 (Exception 2) and Section 714.6 (Section 714.11 in proposal) is changed to "primary structural frame" for better consistency with the changes approved by FS98-06/07. With these changes a clear distinction will be established between "primary structural frame" in the nonstructural provisions of the IBC and "structural frame" in the structural provisions. The use of "structural frame" is found in Sections 2104.2.1, 2109.4.3, 2109.7.4, 2110.1.1, 3402.1 (technically infeasible) and H109.1.

Additional references to the footnotes in Table 601 at the fire-resistance ratings for roof construction in Table 601 are made to restore the original references, which were inadvertently deleted in the 2007 IBC Supplement. Note that Footnotes (c) and (d) in the 2006 IBC are Footnotes (b) and (c) in the 2007 IBC Supplement.

Cost Impact: The code change proposal will not increase the cost of construction.

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G46–07/08

[F] 403.2.1 (New), 403.2.1.1 (New), [F] 403.2.1.1.1 (New), [F] 403.2.1.2 (New), [F] 403.2.2 (New) [IFC 914.3.1.1 (New), IFC 914.3.1.1.1 (New), IFC 914.3.1.1.1.1 (New), IFC 914.3.1.1.2 (New), IFC 914.3.1.2 (New); IFC 509.1 (IBC [F] 911.1)

Proponent: Gary Lewis, Chair, representing the ICC Ad Hoc Committee on Terrorism Resistant Buildings

THIS PROPOSAL IS ON THE AGENDA OF THE IFC CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IFC CODE DEVELOPMENT COMMITTEE.

1. Add new text as follows:

[F] 403.2.1 (IFC 914.3.1.1) Sprinkler riser redundancy and isolation. All buildings that are more than 420 feet (128 m) in height shall have all risers supplying automatic sprinkler systems interconnected to each other at the top and bottom most floor of each vertical riser zone. The interconnections shall be at least as large as the largest riser supplied.

[F] 403.2.1.1 (IFC 914.3.1.1.1) Number of risers and separation. A minimum of two sprinkler water supply risers shall be provided in each vertical riser zone of the building. Sprinkler water supply risers shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between the nearest portion of the sprinkler water supply risers.

[F] 403.2.1.1.1 (IFC 914.3.1.1.1.1) Hydraulic design evaluations. Independent hydraulic design evaluations shall be completed utilizing individual water supply risers for each vertical riser zone. System hydraulic design shall not be based upon redundancy of water supply risers for each vertical riser zone.

[F] 403.2.1.2 (914.3.1.1.2) Control valves. Manual and remote control valves shall be provided on all riser piping supplying automatic sprinkler systems at every third floor of the building served. This requirement is independent of sprinkler floor control valves required by Section 903.4.3

[F] 403.2.2 (IFC 914.3.1.2) Water supply to required fire pumps. Required fire pumps shall draw from a minimum of two independent street level water mains located in different streets.

Exception: When the street level water main is a looped or gridded system, two taps may by drawn from the same main provided the main is valved such that an interruption on one side of the loop or grid can be isolated so that the water supply will continue without interruption through at least one of the taps. Each tap shall be sized to supply the required flow. The taps shall be located as remote from one another as is practicable given the site conditions.

2. Revise as follows:

IFC 509.1 (IBC [F] 911.1) (Supp) Features. Where required by other sections of this code and in all buildings classified as high-rise buildings by the *International Building Code*, a fire command center for fire department operations shall be provided. The location and accessibility of the fire command center shall be approved by the fire department. The fire command center shall be separated from the remainder of the building by not less than a 1-hour fire barrier constructed in accordance with Section 706 of the *International Building Code* or horizontal assembly constructed in accordance with Section 711 of the *International Building Code*, or both. The room shall be a minimum of 96 square feet (9 m^2) with a minimum dimension of 8 feet (2438 mm). A layout of the fire command center and all features required by this section to be contained therein shall be submitted for approval prior to installation. The fire command center shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system unit.
2. The fire department communications system.
3. Fire-detection and alarm system annunciator system.
4. Annunciator visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air-handling systems.
6. The fire-fighter=s control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking stairway doors simultaneously.
8. Sprinkler valve and water-flow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire-fighting equipment and fire department access.
13. Work table.
14. Generator supervision devices, manual start and transfer features.
15. Public address system, where specifically required by other sections of this code.
16. Elevator fire recall switch in accordance with ASME A17.1.
17. Elevator emergency or standby power selector switch(es), where emergency or standby power is provided.
18. Controls and status indicators for remote control valves on vertical sprinkler/standpipe risers

Reason: The purpose of this proposed change is to increase the reliability of fire suppression systems in very tall buildings, those that exceed 420 feet in height, by requiring looping of sprinkler uses and independent street-level water feeds.

The difficulty of fighting fires in very tall buildings ranges from hard to virtually impossible. Accordingly, the reliable functioning of required sprinkler systems is critically important. The National Institute of Standards and Technology (NIST) World Trade Center (WTC) Report documented that the proximate cause of the collapse was a building contents fire that raged out of control, in part at least, because the building's fire sprinkler systems were non-functional due to the initial aircraft attack. Events far less dramatic could knock out or make a sprinkler riser inoperative, thereby leaving the structure very vulnerable to fire.

Recommendation 12 of the NIST WTC report calls for the redundancy of active fire suppression systems to be increased to accommodate the greater risks associated with increasing building height and population. This proposal seeks to do that by providing two water feeds to each floor designed such that the system will function as intended if one of those feeds is damaged or otherwise interrupted.

It is interesting to note that existing standards for water mains in residential subdivisions call for looping and valving to ensure that no more than 20 homes could be cut off by a water main break. Such a break would create a fire suppression risk for 4 people (the average occupancy of one home) or no more than 80 people (assuming all 20 homes catch fire). In contrast, we do not require looping and valving to isolate failure in buildings that might contain 10,000 occupants. This proposal seeks to correct that problem.

Proposed new Subsection 403.2.1 requires the interconnection (looping) of sprinkler risers in each vertical zone.

Proposed new Subsection 403.2.1.1 requires two risers for every zone and specifies a separation distance to reduce the possibility that one incident could incapacitate both risers.

Proposed new Subsection 403.2.1.1.1 ensures that the sprinkler system will be designed to function as intended and required from either riser. This is consistent with the goal of providing redundancy.

Proposed new Subsection 403.2.1.2 requires riser control valves at every third floor of the building. This provision supports the stated intent of this code change by ensuring that a riser break (or other problem eliminating the riser's functionality) will not leave more then two floors without the required sprinkler protection. Standpipe control valves are already required to be monitored and NFPA 14 requires redundancy. However, the control valves required by new section 403.2.1.2 are in addition to the control valves required by NFPA 14. Along with the redundant sprinkler riser that is required by section 403.2.1, the valves required by this new section will assure that any riser break will not leave more than two floors without the required sprinkler protection.

These new valves raise the possibility that someone will inadvertently close one or more. Accordingly, a proposed amendment to Section 911.1 of the Code requires that these automatic valves be able to be monitored from the fire command center by the use of status indicators. This will make it possible to monitor continuously all riser valves from one location and correct any problem from that location.

New Subsection 403.2.2 requires fire pumps to be fed from two independent water mains in separate streets. This will greatly reduce the possibility of the loss of water due to a main break, given the valving which is a feature of public water systems.

Bibliography:

National Institute of Standards and Technology. Final Report of the National Construction Safety Team on the Collapses of the World Trade Center Towers. United States Government Printing Office: Washington, D.C. September 2005.

Cost Impact: This proposal will increase the cost of construction for very tall buildings, but the additional cost is warranted by the additional risk inherent in such buildings.

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G51–07/08

403.4 (New), 403.2 (New)

Proponent: Gary Lewis, Chair, representing the ICC Ad Hoc Committee on Terrorism Resistant Buildings

Add new text as follows:

403.4 Structural performance. Buildings that are more than 420 feet (128 m) in height shall be designed to survive a building contents fire to burnout without more than local failure of the structural frame. The building contents fire shall be analyzed in accordance with Section 1701.3.15 of the *ICC Performance Code for Buildings and Facilities* and shall be based on an approved design fire without sprinkler activation. The design fire shall be a quantitative description of assumed design fire characteristics that can reasonably be expected to occur during the life of the building and shall take into consideration the following: fuel loading; peak heat release rate(s); amount of air available; and confinement of the fire(s). The approved design fire shall be used to conduct a deterministic fire safety engineering analysis. Minimum fire load densities for each specific occupancy within a building shall be based upon approved fire engineering guidelines and shall take into account appropriate safety factors. In a mixed used building, the appropriate fire load for each portion of the building shall be based on the occupancy classification for that portion. The fire resistance rating of the structural frame shall not be less than the fire resistance ratings prescribed in Table 601.

(Renumber subsequent sections)

403.2 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

LOCAL FAILURE. A failure of the area of floor at any story at risk of collapse that does not exceed 15% of the floor area of that story or 750 square feet, whichever is smaller, or does not extend further than the immediate adjacent story.

STRUCTURAL FRAME. The columns and the girders, beams, trusses, and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. Members of floor and roof construction that are not connected to the columns shall be considered secondary members and not part of the structural frame.

(Renumber subsequent sections)

Reason: The purpose of this change is to establish a specific performance objective: that very tall buildings (those over 420 feet in height) be analyzed to ensure that they will survive a building contents fire without collapse. The change is intended to implement Recommendations of the National Institute of Standards and Technology's (NIST) World Trade Center (WTC) report.

It needs to be made clear that this new provision is *not* a performance provision. It merely establishes the same safety objective that forms the basis of the current approach to structural fire resistance, only for buildings at high risk due to the consequence of failure. In these buildings it is necessary that the safety objective be demonstrated by calculation rather than by the standard fire resistance test. To clarify that the current prescriptive approach is based on burnout without collapse, here is a brief historical perspective…

As a result of the Baltimore fire of 1904, ASTM organized Committee P on Fireproofing Materials in 1905. In 1917, Committee C-5 (renamed from Committee P) prepared a standard, C 19, (later designated E 119) which was adopted in 1918 as a specification for "Fire Tests of Materials and Construction." This standard introduced the standard time-temperature (furnace heating) curve which has remained essentially unchanged to this day. It is interesting to note that the standard heating curve was developed by consensus and was not based on temperatures achieved during a full burnout (Hall 2004). Ingberg's work at NBS (now NIST), however, led to the empirical relationship between fuel load, fire duration, and structural resistance in units of time (Bukowski 2006) and provided the scientific basis for the time-temperature curve approach to fire safety design. It was generally held that the standard time-temperature curve represented a limiting condition for a ventilation-controlled fire with typical fuel loads and ventilation characteristics of most buildings (Bukowski 2006). The fire safety design objective was that, under the worst case conditions (i.e., no suppression), all of the combustibles in the compartment should be consumed without causing failure of any structural member – that is, burnout without local or global collapse (Bukowski 2006).

When the standard fire curve was introduced in 1918, bay sizes were smaller than they are today, buildings heights were less, materials of construction were different than those used today, and combustibles had different burning characteristics than modern materials. The proposed code change is completely consistent with the *basis* for today's prescriptive approach to fire safety and is intended to insure that, for high-rise buildings – those buildings that pose the highest risk due to the consequence of failure – the basic fire safety design objective of burnout without local or global collapse is achieved.

Furthermore, by not specifying the design fire in the proposal, the engineer may utilize any number of resources for specifying the characteristics of a fire that can reasonably be expected to occur during the life of the building such as: the *SFPE Engineering Guide to Performance-Based Fire Protection* (SFPE), Chapter 8 – Developing Design Fire Scenarios; *Structural Design for Fire Safety* by Andrew Buchanan (Wiley); Chapter 4 Room Fires; Section 4.5 Design Fires; ISO/DTS 16733 "Fire Safety Engineering – Selection of design fire scenarios and design fires" (draft technical standard); Eurocode 1: Actions on structures, Part 1-2: General actions – Actions on structures exposed to fire (EN 1991-1-2:2002); Section 2 Structural fire design procedures.

Bukowski, Richard W. (2006). "Determining Design Fires for Design-Level and Extreme Events,"SFPE 6th International Conference on Performance- Based Codes and Fire Safety Design Methods, June 14-16, 2006, Tokyo.

Hall, John R. (2004). "A Century of Fire Standards," Standardization News, December 2004, ASTM International, West Conshohocken, Pennsylvania

Cost Impact: This proposal may increase the amount of passive fire protection in very tall buildings and so increase costs. The proponents believe that there will be some increased costs in many very tall buildings, but that costs will be both moderate and warranted when the performance analysis demonstrates a potential weakness.

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G52–07/08

403.4 (New), 403.2 (New)

Proponent: Ramon Gilsanz, Gilsanz Murray Steficek LLP

Add new text as follows:

403.4 Structural performance. Buildings that are more than 420 feet (128 m) in height shall be designed to survive a fire that burns until all combustible material is consumed without more than local collapse of the structural frame through compliance with Section 403.15.1 or 403.15.2.

403.4.1 Prescriptive method. The fire resistance rating of the structural frame and floor construction shall be a minimum of 4 hours.

403.4.2 Performance method. The structural response shall be calculated under the design fire conditions to verify that it does not produce more than a local collapse. The fire-resistance rating of the structural frame shall not be less than the current fire resistance rating prescribed in Table 601. The design fire shall assume sprinklers do not activate. The approved design fire shall address the following: fuel loading; peak heat release rate(s); amount of air available; and confinement of the fire(s). Minimum fire load densities for each specific occupancy within a building shall be based upon approved fire engineering guidelines and shall take into account appropriate safety factors. In a mixed used building, the appropriate fire load for each portion of the building shall be based on the occupancy classification for that portion.

(Renumber subsequent sections)

403.2 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

LOCAL COLLAPSE. Failure of a structural element that results in the collapse of areas being directly supported by that element and not extending vertically more than three stories.

STRUCTURAL FRAME. The columns and the girders, beams, trusses, and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. Members of floor and roof construction that are not connected to the columns shall be considered secondary members and not part of the structural frame.

Reason: The purpose of this change is to establish the objective that very tall buildings (those over 420 feet in height) be analyzed to ensure that they will survive a building contents fire without collapse. Currently, it is unclear whether modern building styles can resist a total fire burnout without collapse. Until proper testing and analysis is completed it is necessary to raise the minimum fire resistance for public safety.

The goal of the structural engineering community should be to design buildings to resist collapse from fire in a manner similar to designing buildings to resist collapse when exposed to other loads (i.e. gravity, earthquakes, wind, etc.). Engineers design structures to withstand a number of potential damaging events. These events cause losses of different magnitudes, give varying levels of warning to the public, and occur with different frequencies. An earthquake does not give any warning, whereas the public is forewarned about a flood. We know that the economic loss due to a flood or an earthquake can be comparable, but because of the difference in warning times, a flood may lead to a smaller loss of human life than an earthquake.

The frequency of occurrence of each event is characterized by the probability of that event happening in any given year, and the probability of occurrence is measured by the return period. The code earthquake loads have a 2500 year return period, meaning the probability that an earthquake of the design intensity happens in a given year is 1 in 2500. The code wind load has a 500 year return period. The code flood loads have a 150 year return period. Events that give the public more warning have smaller return periods because they present a lesser threat to human life.

Fires occur without warning and can cause significant economic and human loss. Fire statistics of the past 30 to 40 years for buildings less than 100 years old may not provide a complete picture of the risk the public faces or the potential economic loss. Engineers and building professionals should establish the proper return period for fire design, the risks of building collapse due to fire, and the associated losses. As an example, even though New York City has not suffered any significant earthquake losses to date, in 1995, after evaluating whether the benefits merit the costs, the City added seismic design requirements to the building code. Although the seismic threat is small, it was still deemed significant enough to merit structural design. The threat of fire can also be substantial, and should warrant sufficient structural design as well.

Although the probability of a fire suppression system failing is low, the impacts of such a failure are significant. The public, in recent tragic disasters, has demonstrated intolerance to large life loss potentials regardless of the infrequency of such events. This code proposal would help confirm to the public that the tall buildings they or their loved ones use will not collapse under a total fire burnout. When a building collapses due to fire, its occupants and emergency responders are placed at risk, and there is potential for economic loss to the building, to neighboring structures, and to the city. In addition, in high-rise buildings, occupants may become trapped above fire level, and their safety depends on the capability of the building to avoid collapse.

The increase of the prescriptive fire resistance to four hours is based on research done for a 1942 report BMS92, “Building Materials and Structures: Fire Resistance Classifications of Building Constructions” issued by the National Bureau of Standards. This report defines “fireproof construction” as, “that type of construction in which the structural elements are of incombustible materials with fire resistance ratings sufficient to withstand the fire severity resulting from the complete combustion of the contents and finish involved in the intended occupancy”, with the resistance not less than specified minimum ratings. For Type I construction, this report sets the minimum fire resistance to 4 hours for the structural frame and floor construction. Implementing a firm definition of “fireproof construction” such as that issued in 1942 is necessary. As the viability of the current minimum values has been shown to be questionable it is necessary that they be raised until validated. Raising the values will help prevent building collapse due to burnout and ensure that modern construction is fireproof.

This increase is a reversal of the relaxation in fire resistance ratings that has occurred since the early 1900’s. They were relaxed due to the installation of fire suppression systems and the limited number of significant fires in large buildings. Over the years, the required fire resistance of major structural elements has been progressively reduced from an original requirement of 4-hour to as low as 1-hour resistance when tested using the ASTM E119 procedures. Whether relaxing the prescriptive requirements for an economic reason was correct has not been technically confirmed. This places a heavy reliance on sprinklers and fire suppression systems, with the assumption that they will be properly maintained and fully operational at the time of a fire. Until this reliance is proven to be well-founded, buildings should be designed to resist collapse due to fire in the event that a fire suppression system fails. Fire suppression systems are important life-saving devices, and the intent is not to replace them with burnout design. Rather, structural design for total burnout should supplement fire suppression systems; both should be required.

In addition to the reduction in the prescriptive requirements over time, their use has also been expanded for application to new materials and assemblies. Behavior of these new components and materials is determined through testing. The behavior of the whole system is then extrapolated from the component behavior. Although this approach is usually reasonable, its validity for new methods of construction, such as those using larger bay sizes, different and lighter materials, and different connections is unclear. The assembly may behave differently than what is predicted from the behaviors of its different components considered independently. Unfortunately, the American Society for Testing and Materials (ASTM) procedures do not address the impact of fire on the integrated structural system.

Our European counterparts have conducted full-size fire tests in Cardington, UK, demonstrating the satisfactory behavior of steel structures under total fire burnout. Unfortunately, in the US, our steel connection types differ from, and are not as strong as, the English connections that have axial strength requirements. Therefore, the UK tests cannot be applied to structures in the US. To date, we have not conducted full-size tests of our buildings. These tests, if conducted, could verify whether our current design practices are sufficient protection in the event of a total burnout. They could also reveal the strengths and weaknesses in our building design practices.

On September 11th, the failure of towers 1 and 2 of the World Trade Center (WTC) proved to us that buildings that are structurally damaged can collapse due to fire. The partial collapse of WTC 5 from fire was due to a particular steel framing system, and the total collapse of WTC 7 may be attributed in large measure to the fire in the building. The high rise building fire at One Meridian Plaza, Philadelphia, in 1991, burned 9 of the 38 floors, but the structure did not collapse. In all these buildings, the fire suppression system was not operational or was only partially operational at the time of the fire.

The uncertainty in the structural performance of buildings under total fire burnout has also been witnessed in other countries. The 2000 fire in the 540 m tall (1,772 ft) Moscow, Russia Ostankino TV tower started at 440 m (1,443 ft) and burnt down to 100 m (328 ft) above ground, tilted the spire 2 meters (6.5 ft), and lasted 24 hours. As the authorities were uncertain whether the tower would collapse, for security, they created a 700 meter (2,296 feet) exclusion zone around the tower and removed fuel from nearby fuel stations. In 2004, a fire collapsed a 12 story building in Nasr, Egypt after only 3 hours, and, in 2005, the Windsor building in Madrid, Spain burnt for 18 hours, suffered a very significant partial collapse and was later demolished. These losses, their varying burnout times, and the degree of structural failure, relay the uncertainty of whether our current designs can withstand the threat of total burnout.

By increasing the fire resistance ratings and calculating the design fire, engineers can both ensure building safety and have the opportunity to witness the strengths and weaknesses of our modern structures. The engineer may utilize any number of resources for specifying the characteristics of a design fire that can reasonably be expected to occur during the life of the building such as: the *SFPE Engineering Guide to Performance-Based Fire Protection* (SFPE), Chapter 8 – Developing Design Fire Scenarios; *Structural Design for Fire Safety* by Andrew

Buchanan (Wiley); Chapter 4 Room Fires; Section 4.5 Design Fires; ISO/DTS 16733 "Fire Safety Engineering – Selection of design fire scenarios and design fires" (draft technical standard); Eurocode 1: Actions on structures, Part 1-2: General actions – Actions on structures exposed to fire (EN 1991-1-2:2002); Section 2 Structural fire design procedures.

In summary, it would behoove us to face the potential challenges that may arise with the enactment of this proposition. The advantages of having buildings that remain standing after burnout far outweigh the possible costs. Similar challenges were accepted and resolved by our predecessors, leading to major life-saving enhancements in structural design. This proposal, with its potential for a no-cost impact, should be embraced and implemented for the well-being of future generations.

Bibliography:

Federal Emergency Management Agency. "World Trade Center Building Performance Study: Data Collection, Preliminary Observations, and Recommendations." FEMA 403. May 2002.

Kevin LaMalva. "Failure Analysis of the World Trade Center 5 Building." Worcester Polytechnic Institute. Student Research. M.A. 2007

National Bureau of Standards. "Building Materials and Structures, Report BMS92: Fire Resistance Classifications of Building Constructions" Report of Subcommittee on Fire-Resistance Classifications of the Central Housing Committee on Research Design and Construction. United States Government Printing Office. Washington, D.C. October 7, 1942.

United States Fire Administration. "Technical Report Series: High Rise Office Building Fire, One Meridian Plaza, Philadelphia (February 23rd 1991)." Federal Emergency Management Agency. United States Fire Administration. National Fire Data Center. << http://www.interfire.org/res_file/pdf/Tr-049.pdf>>

Cost Impact: The cost of this proposal will depend upon the analysis option chosen and the strength of our modern building methods. If the engineer opts to use the 4-hour fire resistance there will be an increased cost. If the engineer uses the performance approach there will either be no-cost impact in the event that the calculations validate the current minimum values, or a cost that ensures the structure does not collapse.

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G53–07/08

[F] 403.7

Proponent: Tom Lariviere, Fire Department, Madison, MS, representing the Joint Fire Service Review Committee

THIS PROPOSAL IS ON THE AGENDA OF THE IFC CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IFC CODE DEVELOPMENT COMMITTEE.

Revise as follows:

[F] 403.7 Emergency responder radio ~~Fire department~~ communications system. ~~A two-way fire department communications system shall be provided for fire department use in accordance with Section 907.2.12.3.~~ An emergency responder radio communications system shall be installed where required to provide the required level of radio coverage for emergency responders by allowing radio frequencies to be transmitted and received throughout the building. Amplifiers shall be able to handle the frequencies in operation by the local emergency responder agencies. A permanent sign shall be installed in the fire command center indicating the presence of the amplification system and the frequencies served.

Reason: To allow the emergency services to communicate properly throughout the building during an emergency. This proposal will replace the typical hardwired communications system with a radio system that will work with the FD radio system and provide adequate radio communications

Cost Impact: The code change proposal will increase the cost of construction.

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G56–07/08

403.12 (New)

Proponent: Gary Lewis, Chair, representing the ICC Ad Hoc Committee on Terrorism Resistant Buildings

THIS PROPOSAL IS ON THE AGENDA OF THE IBC STRUCTURAL CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IBC STRUCTURAL CODE DEVELOPMENT COMMITTEE.

Add new text as follows:

403.12 Structural integrity of exit stairway enclosures. For all buildings that are more than 420 feet (128 m) in height, exit stairway enclosure wall surfaces, from the top of each floor to the underside of the floor or roof above and connections to supporting members, shall be capable of resisting a factored load using strength design, expressed as a uniform pressure, of not less than 2 pounds per square inch (psi) applied perpendicular to the exterior of the enclosure. This load need not be assumed to act concurrently with the loads specified in Chapter 16 and shall be assumed to apply to one floor at a time.

Reason: The purpose of this change is to establish a standard for the structural robustness of exit stairway enclosures. It implements Recommendation 18 of the National Institute of Standards and Technology (NIST) report on the World Trade Center (WTC) tragedy.

The Code has traditionally looked upon a stair enclosure as a place of relative safety. There are any number of carefully crafted code provisions designed to ensure that goal, but they are based upon only one hazard – fire. The enclosures of these stairs are made fire resistive through the traditional rating and listing system, but the Code does not establish a criterion for structural robustness. The proponents do not believe that the existing "hose stream" test addresses this issue. The hose stream does not and cannot represent the real world impact of blast loads that a stair shaft might encounter. Neither does the ongoing industry work designed to develop an impact resistance test standard. That work relates to durability rather than safety. The proponents believe that a structural standard is needed.

The stair enclosures of the WTC were destroyed by an aircraft impact. Far lesser events, such as a gas explosion or a vehicle impact (on lower floors) can destroy a stair enclosure, especially when one considers that the Code contains no structural criteria at all. The 2 psi load requirement is consistent with the overpressure associated with a gas explosion. NIST has performed an analysis to verify this statement. Any structural robustness that existing stair shaft enclosures have is a by-product of the fire rating process; a process that was never intended to provide structural integrity.

A new criterion is needed for exit stair enclosures – a structural one.

The NIST WTC Report suggests a standard based upon resistance to over-pressure. This approach has two real advantages. It reflects one possible damage scenario and can represent others as well. Secondly, it is a performance standard. All materials can be analyzed and engineered to comply.

Compliance with this standard is determined by engineering analysis, not a test. This is a simple and direct approach that can be implemented immediately.

Bibliography:

National Institute of Standards and Technology. Final Report of the National Construction Safety Team on the Collapses of the World Trade Center Towers. United States Government Printing Office: Washington, D.C. September 2005.

Cost Impact: This proposal will increase the cost of construction but the continued absence of structural criteria for exit stairway enclosures is not possible. This is a cost that must be met for safety's sake.

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G57–07/08

403.12 (New)

Proponent: Greg Lake, Sacramento Metropolitan Fire District, representing the California Fire Chiefs Association (Cal Chiefs)

THIS PROPOSAL IS ON THE AGENDA OF THE IBC FIRE SAFETY CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IBC FIRE SAFETY CODE DEVELOPMENT COMMITTEE.

Add new text as follows:

403.12 Exit stairway shaft enclosure integrity. For buildings greater than 420 feet in height above grade plane, the fire-resistance rating of the exit stairway enclosure walls shall be determined by meeting the conditions of acceptance specified in ASTM E119 with the hose stream test conducted at the end of the fire test for the original test specimen to determine the integrity of the wall.

(Renumber subsequent sections)

Reason: Cal Chiefs has decided to submit this code change proposal as a result of discussions which occurred during the Public Hearings held at the ICC Final Action Hearings on Code Change Proposals G70-06/07 submitted by the Masonry Alliance for Codes and Standards (MACS) and G73-06/07 submitted by the Ad Hoc Committee on Terrorism Resistant Buildings to address the issue of the physical integrity of exit stairway shaft enclosures in super high rise buildings (those buildings greater than 420 in height). Both code changes received significant debate but were subsequently disapproved. However, the Class A voting membership was able to successfully overturn the Committee's recommendation for disapproval of Code Change G70-06/07 but was unsuccessful in achieving the necessary two-thirds majority vote for approval of the code change. We believe that code change had merit so we reviewed it and revised it to better clarify it and make it more enforceable in our opinion based on this code change submittal.

It is clear in the NIST Final Report of the National Construction Safety Team on the collapse of the World Trade Center Towers which can be found on the NIST website at www.NIST.gov that there is a need to provide a means for determining minimum structural integrity criteria for the means of egress in very tall buildings which includes the exit stairways, as well as elevator hoistways for elevators that may be used for emergency access by emergency responders, or as a method of emergency evacuation, especially for people with disabilities. Recommendation

18 in Chapter 9 of the NIST Report stated the following:

> "NIST recommends that egress systems (i.e. stairs, elevators, exits) should be designed … (2) to maintain their functional integrity and survivability under foreseeable building-specific or large-scale emergencies…"
>
> Item B in this recommendation further states:
>
> "The design, functional integrity, and survivability of the egress and other life safety systems, (e.g., stairwell and elevator shafts…) should be enhanced by considering accidental structural loads such as those induced by overpressures (e.g., gas explosions), impacts, or
>
> major hurricanes and earthquakes, in addition to fire separation requirements… The stairwells and elevators shafts… should have adequate structural integrity to withstand accidental structural loads and anticipated risks."

In other words, the exit stairway shaft enclosures should be "hardened" beyond what they may be today based on the fire tests currently prescribed in ASTM E119.

We believe that the most direct and effective approach at this time based on the use of nationally recognized standards to determine the structural integrity of the exit stairway shaft enclosure walls is to specify that when the fire-resistance rating for the wall assembly is determined in accordance with ASTM E119, that it is based on the hose stream test portion of the test being conducted at the end of the fire-resistance test for the original test specimen. That is one of three options prescribed in ASTM E119 for when the hose stream test is to be applied. Another option for applying the hose stream test for wall assemblies having a fire-resistance rating of 1-hour or more is to test a second test specimen for one-half the duration of the fire-resistance rating determined by the original test specimen but for not more than 1-hour and then apply the hose stream test. So for a 2-hour fire-resistance rated wall which would be required for these shaft enclosures, the hose stream test under that option would be applied after a 1-hour fire-resistance test has been conducted on a duplicate test specimen of the original 2-hour fire-resistance rated wall assembly. It is obvious to us that if we specify the hose stream test to be conducted at the end of the fire-resistance test for the original test specimen, the wall must be substantially more robust and "hardened" in order to withstand the "impact, erosion, and cooling effects of a hose stream" as specified in Section 11.1 of ASTM E119. The purpose of the hose stream test is also explained in Appendix X5 Commentary to ASTM E119. Section X5.9 Integrity states: "In this hose stream test, the ability of the construction to resist disintegration under adverse conditions is examined."

As representatives of the fire service, we are very concerned that the stairway exit enclosures in these very tall buildings be sufficiently "hardened" to assure that they will withstand various impacts and stresses that may occur during an uncontrolled fire. This is especially important since we may be utilizing the stairs to assist in evacuation of the occupants of the building. In the NIST Report it was estimated that the evacuation of a fully occupied World Trade Center Tower would have taken approximately 4 hours. And, of course, we may need to deal with evacuation of disabled occupants utilizing these exit stairways as well. Also, the responding fire department may also utilize these exit stairways to gain access to the fire floor. It was also noted in the NIST Report that it was estimated that the fire department response using the stairways to gain access to the 58th floor of a hypothetical 60 story building for fire fighting operations and rescue purposes would require at least 90 minutes provided the fire department personnel were not carrying any equipment or breathing apparatus but could take as much as 120 minutes if the emergency responders were in fact carrying equipment and breathing apparatus.

In conclusion, Cal Chiefs strongly supports the need to "harden" the exit stairway enclosures in these super high rise buildings in order to provide adequate fire and life safety for not only the occupants of the building but also for the responding fire department and other emergency personnel who may be using those stairs to gain access to the fire floor, as well as to assist in evacuation of the occupants. We believe that this code change proposal will provide that additional degree of integrity for "hardening" these exit stair enclosures.

Cost Impact: This code change will increase the cost of construction.

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G58–07/08

403.12.1, 707.14.1, 3002.3 (New), 3006.4, Chapter 35 (New); IFC 509.1 (IBC [F] 911.1)

Proponent: Gary Lewis, Chair, representing the ICC Ad Hoc Committee on Terrorism Resistant Buildings

THESE PROPOSALS ARE ON THE AGENDA OF THE IBC GENERAL AND IFC CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES

PART I – IBC GENERAL

1. Revise as follows:

403.12.1 Stairway communications and monitoring system. The following stairway communication and monitoring systems shall be installed at every fifth floor of each required stairway and connected to an approved constantly attended station:

1. ~~A~~ Telephone or other two-way communications system ~~connected to an approved constantly attended station shall be provided at not less than every fifth floor in each required stairway where the doors to the stairway are locked.~~
2. Video surveillance system installed in accordance with NFPA 731.

2. Revise as follows:

707.14.1 (Supp) Elevator lobby. An enclosed elevator lobby shall be provided at each floor where an elevator shaft enclosure connects more than three stories. The lobby shall separate the elevator shaft enclosure doors from each floor by fire partitions equal to the fire-resistance rating of the corridor and the required opening protection. Elevator lobbies shall have at least one means of egress complying with Chapter 10 and other provisions within this code. In buildings with an occupied floor more than 75 feet above the lowest level of fire department vehicle access, the elevator lobby shall be provided with a video surveillance system installed in accordance with NFPA 731.

Exceptions:

1. Enclosed elevator lobbies are not required at the street floor, provided the entire street floor is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Elevators not required to be located in a shaft in accordance with Section 707.2 are not required to have enclosed elevator lobbies.
3. Where additional doors are provided at the hoistway opening in accordance with Section 3002.6. Such doors shall be tested in accordance with UL 1784 without an artificial bottom seal.
4. In other than Group I-2 and I-3, and buildings having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access, enclosed elevator lobbies are not required where the building is protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
5. Smoke partitions shall be permitted in lieu of fire partitions to separate the elevator lobby at each floor where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
6. Enclosed elevator lobbies are not required where the elevator hoistway is pressurized in accordance with Section 707.14.2.

3. Add new text as follows:

3002.3 Elevator hoistway monitoring. In buildings with an occupied floor more than 75 feet above the lowest level of fire department vehicle access, the elevator hoistway shall be provided with a video surveillance system installed in accordance with NFPA 731 at the top of each elevator hoistway mounted to look down the hoistway in the direction of the top of the elevator cab. A reflective material shall be mounted to the top of the elevator cab such that the reflection will be observable by the video surveillance system at the lowest stop of the elevator cab. The reflector shall be no less than two inches (5.1cm) by 12 inches (30.5 cm).

(Renumber subsequent sections)

4. Revise as follows:

3006.4 (Supp) Machine rooms and machinery spaces. Elevator machine rooms and machinery spaces shall be enclosed with fire barriers constructed in accordance with Section 706 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall not be less than the required rating of the hoistway enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies having a fire protection rating not less than that required for the hoistway enclosure doors. In buildings with an occupied floor more than 75 feet above the lowest level of fire department vehicle access, the machine room shall be provided with smoke detectors and a video surveillance system installed in accordance with NFPA 731.

Exceptions:

1. Where machine rooms and machinery spaces do not abut and have no openings to the hoistway enclosure they serve the fire barriers constructed in accordance with 706 or horizontal assemblies constructed in accordance with Section 711, or both, shall be permitted to be reduced to a 1-hour fire-resistance rating.
2. In buildings 4 stories or less, above grade plane when machine room and machinery spaces do not abut and have no openings to the hoistway enclosure they serve, the machine room and machinery spaces are not required to be fire-resistance rated.

5. Add standard to Chapter 35:

NFPA

731 The Standard for the Installation of Electronic Premises Security Systems

PART II – IFC

Revise as follows:

509.1 (IBC [F] 911.1) (Supp) Features. Where required by other sections of this code and in all buildings classified as high-rise buildings by the *International Building Code*, a ~~fire~~ emergency command center for ~~fire department~~ emergency operations shall be provided. The location and accessibility of the ~~fire~~ emergency command center shall be approved by the fire department. The ~~fire~~ emergency command center shall be separated from the remainder of the building by not less than a 1-hour fire barrier constructed in accordance with Section 706 of the *International Building Code* or horizontal assembly constructed in accordance with Section 711 of the *International Building Code*, or both. The room shall be a minimum of 96 square feet (9 m2) with a minimum dimension of 8 feet (2438 mm). A layout of the ~~fire~~ emergency command center and all features required by this section to be contained therein shall be submitted for approval prior to installation. The ~~fire~~ emergency command center shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system unit.
2. The fire department communications system.
3. Fire-detection and alarm system annunciator system.
4. Annunciator visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air-handling systems.
6. The fire-fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking stairway doors simultaneously.
8. Sprinkler valve and water-flow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Building emergency resource manual approved by the fire department that includes emergency operation instructions and ~~Schematic~~ building plans indicating the typical floor plan and detailing the building core, means of egress, as well as the layout and operating instructions for the emergency aspects of fire protection systems, HVAC systems, elevator controls, communication systems, utilities, fire-fighting equipment and fire department access.
13. Work table.
14. Generator supervision devices, manual start and transfer features.
15. Public address system, where specifically required by other sections of this code.
16. Elevator fire recall switch in accordance with ASME A17.1.
17. Elevator emergency or standby power selector switch(es), where emergency or standby power is provided.
18. Video monitoring for video surveillance system required by the *International Building Code* and any others used to monitor conditions or activities in the building.
19. Status indication of smoke detectors and video surveillance system for elevator machine rooms.
20. Controls and valve status indicators for remote control valves on sprinkler/standpipe vertical risers.

In buildings that are more than 420 feet (128 m) in height, systems and equipment for features 1, 2, 3, 4, 7, 15, and 20 shall be provided with redundant circuitry during normal and emergency operating modes and shall have the ability to transmit and communicate off-site, including mobile access, if required by the Fire Department.

Reason: The purpose of this change is to increase the ability of firefighters, and other emergency responders, to develop a clear picture of conditions throughout the building which will enable them to better manage evacuation, fire suppression and other emergency response activities. The purpose is also to enhance the safety of emergency responders by enabling them to maintain better situational awareness.

The National Institute of Standards and Technology's (NIST) report on the World Trade Center (WTC) tragedy amply documented the tactical and informational difficulties experienced by emergency responders and occupants during the WTC event. Similar difficulties occur in much smaller events and they place lives at risk.

The Code already requires many systems which enhance emergency responder and occupant awareness. Their use can be improved and they can be further supplemented. Recommendations 13, 14, and 15 of the WTC Report outline a number of valuable measures which are reasonable and practical. To the extent appropriate, this proposal seeks to incorporate those provisions into the Code.

This proposal seeks to improve responder awareness of conditions in the building to assist in management of an incident, improve the existing fire command center to enhance its value, require the off-site transmission of the key data available in the center, require redundancy of key emergency circuits and improve the robustness and the location of the center.

Awareness is improved by requiring control center monitoring of:

1. Video surveillance in stairway shafts, elevator lobbies, elevator hoistways, and elevator machine rooms as well as any other video in the building,
2. Remote controls and status indicators for risers and remote control valves.
3. Status indicators for all smoke detectors.

The value of the fire control center already required by the Code is enhanced by the additional monitoring made possible, and a strengthened "Emergency Resource Manual" which will now include operating instructions for emergency systems as well as information on the emergency aspects of HVAC systems, elevator controls, communication systems and utilities. The center is retitled the emergency command center to reflect its role in managing emergencies other than fire emergencies.

New language at the end of amended Section 911.1 requires the ability to transmit the information available in the center to off-site fire command facilities including mobile facilities.

There will those opponents that will claim that that the amount of information generated by the video monitoring in a large building will cause "information overload". They will question the ability of the staff in the fire command center to observe all of the required video feeds at once. In response to this, please be aware that there is commercial off-the-shelf "intelligent software" that is available such that the staff of the fire command center need not observe all of these feeds; the software is "event driven" and will select information that is pertinent and display just this information. This software is currently available off-the-shelf from companies such as Johnson Control and Honeywell. The Port Authority of New York and New Jersey is currently installing a system to monitor the perimeter of the Newark airport by the use of ***ONE*** video screen. Clearly the perimeter of this airport is substantially larger than the portions of the building that are required to be monitored as a result of this code change. By requiring these video feeds, the situational awareness of the staff in the fire command center is substantially increased. While researching the availability of this software, we were informed by Mr. Alan Reiss the building manager of the World Trade Center, that he was unaware of the magnitude of the event on September 11, 2001. In fact, he commented that the people at home watching the television had a better situational awareness than he did because of the lack of information available at the fire command center. This has to be changed and this proposal will change it.

Bibliography:

National Institute of Standards and Technology. Final Report of the National Construction Safety Team on the Collapses of the World Trade Center Towers. United States Government Printing Office: Washington, D.C. September 2005.

Cost Impact: These proposed amendments will increase the cost of construction, but, the increase will be modest when viewed as a percentage of total construction costs.

Analysis: A review of the standard proposed for inclusion in the code, NFPA 731, for compliance with ICC criteria for referenced standards given in Section 3.6. of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.

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G60–07/08

403.14 (New), 3007.3 (New)

Proponent: Ed Donoghue, Edward Donoghue Associates Inc. (EADAI)

Add new text as follows:

403.14 Pressurized exit enclosures. Exit enclosures connected to a lobby serving a fire service access elevator shall be pressurized in accordance with Section 909.20.5.

(Renumber subsequent sections)

3007.3 Pressurization system. Hoistways containing fire service access elevators and fire service access elevator lobbies, shall be designed in accordance with Sections 707.14.2.1 through 707.14.2.5. Where the fire service access elevator lobby at the street floor is not enclosed, the entire area open to the elevator entrances shall be pressurized to a pressure substantially equivalent to the pressure within the hoistway at the street level. The pressurization system serving the fire service access elevator and the associated exit enclosure shall be designed to function with any two doors open to unpressurized areas.

(Renumber subsequent sections)

Reason: The Robust Fire Service Elevators (RFSE) needs to be protected from smoke entering either the hoistway directly or through the lobby or stair system that adjoins the RFSE. The proposal for a Fire Service Elevator approved during the last cycle includes elevator lobbies protected as Smoke Barriers, however the Hazard Analysis determined this was insufficient to provide the resistance to smoke intrusion necessary for these RFSE's to be of value for an extended period during a building fire.

This proposal requires that the elevator hoistway, enclosed elevator lobbies and stairways directly accessed from the lobby that are contiguous with the RFSE be pressurized at levels identical to those used for stair pressurization in high rises currently. Recognizing that in many cases one or more elevator doors and doors to either the corridor or stair system could be open (egress or blocked by fire hoses), the pressurization system must be sized to provide an adequate differential pressure even with multiple doors open.

In addition this pressurization system will be activated either by General Alarm or by the detectors involved in initiating Phase 1 recall to maximize the protection opportunity. The pressurization system must be able to function for an extended period of time to provide for extended use of the RFSE by the Fire Service even in the event of primary power loss to the elevators and pressurization system. Finally the same requirements for supply air as required for the elevator shaft pressurization system (707.14.2) are required for this system.

Background. As a result of the September 11, 2001 attacks on the World Trade Center, code provisions for emergency egress from tall buildings are being re-examined. There is renewed interest in the use of elevators for both occupant egress and fire fighters access. Therefore a Workshop on the Use of Elevators in Fires and Other Emergencies was held March 2-4, 2004, in Atlanta, Georgia. The workshop was cosponsored by American Society of Mechanical Engineers (ASME International), National Institute of Standards and Technology (NIST), International Code Council (ICC), National Fire Protection Association (NFPA), U.S. Access Board, and the International Association of Fire Fighters (IAFF).

The workshop focused on two general topics:

(1) Use of Elevators by Fire fighters and

(2) Use of Elevators by Occupants during Emergencies

To follow up on the ideas generated at the workshop, 2 task groups were formed; one for each topic. Their goals are:

- Review the suggestions from the Workshop on the Use of Elevators in Fires and other Emergencies.
- Develop a prioritized list of issues.
- Conduct a hazard analysis of the prioritized list of issues to see if there are any residual hazards.
- Draft code revisions for those issues that survive the process and the task group members still want addressed.

The membership of these task groups is broad and includes representatives from the elevator industry and manufacturers of devices such as fire alarms, the fire service, model codes and standards development organizations, and the accessibility community as well as fire protection engineers, architects and specialists in human factors and behavior. Since February 2005 the groups have each been conducting a hazard analysis on their assigned topic. The results of the hazard analysis focused upon the fire fighter needs is nearing completion.

The task group studied 16 different cases. In these cases a particular hazard followed by a cause/trigger was reviewed. The result of the hazard interacting with cause/trigger events may create a particular incident/effect. To address possible incident/effects corrective actions are proposed. Such corrective actions are then reviewed to see if they create any residual hazards. The hazard analysis then carries out each of the residual hazards with additional corrective actions until the hazard is mitigated. It is strictly a hazard analysis (I.e. not probabilistic) and certain assumptions were made such as a single fire start in a high rise building. The following link provides a summary of the cases reviewed for the fire service elevator hazard analysis (PROVIDE LINK).

The code changes generated by this analysis are related both to the summary of corrective actions resulting from the hazard analysis and the existing language related to fire service access elevators placed into the 2007 Supplement.

These proposals will work with the 2007 Supplement requirements for fire service access elevators to address these concerns. It should be noted that the hazard analysis assumed a lobby to be directly connected with the fire service access elevator thus making the result of the analysis consistent with the philosophical approach found in the 2007 Supplement.

Cost Impact: The code change proposal will increase the cost of construction.

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G61–07/08

403.12 (New)

Proponent: Gary Lewis, Chair, representing the ICC Ad Hoc Committee on Terrorism Resistant Buildings

THIS PROPOSAL IS ON THE AGENDA OF THE IBC MEANS OF EGRESS CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IBC MEANS OF EGRESS CODE DEVELOPMENT COMMITTEE.

Add new text as follows:

403.12 Remoteness of exit stairway enclosures. The nearest wall of separate required exit stairway enclosures shall be placed a distance apart equal to not less than one-third of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between the nearest portion of the stairway enclosure. In buildings with three or more exit stairway enclosures, at least two of the exit stairway enclosures shall be placed a distance apart equal to not less than one-third of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between the nearest portion of the exit stairway enclosure. Interlocking or scissor stairs shall be counted as one exit stairway.

Reason: The purpose of this change is to add a new Section 403.19 that will require stair shafts to meet remoteness criteria, in addition to the separation distance requirements for exit access doorways of Section 1015.2.1.

The Code has long contained requirements designed to ensure that all the exit access doors on a floor are not grouped closely together. Grouping exit access doors too closely defeats the whole point of multiple exits.

The National Institute of Standards and Technology's (NIST) report on the World Trade Center (WTC) tragedy recommends a new remoteness criterion for stair shafts (Recommendation 18). The report pointed out that, at some locations, stairs that met the exit access distance requirements were, nonetheless, very closely grouped. Their shafts were very close together and all three were destroyed by the airplane impact, thereby dooming all above. It is not the proponents' intent to make stair shafts immune to airplane attacks but the re-examination of our basic criteria that was prompted by the attack and the WTC Report suggests that far less dramatic events could render more than one stair shaft unusable. The cause need not be an act of terror either. There are other explosive hazards in high rise buildings. It is only prudent to separate the stair shafts themselves as well as the exit access doors.

It is possible that, in some high rise office buildings, this provision will result in one or more stairs being across the hall from the core rather than in the core. No additional floor area will be required for the sum total of core and stairs. If a stair is outside the traditional core, then the core itself will be smaller. Some might suggest that such a stair location might inhibit design flexibility in tenant spaces. This is simply not true. The architect might have to work a little harder to develop layouts but, with a little skill, any constraint can be incorporated into an acceptable design.

Bibliography:

National Institute of Standards and Technology. Final Report of the National Construction Safety Team on the Collapses of the World Trade Center Towers. United States Government Printing Office: Washington, D.C. September 2005.

Cost Impact: The proposal will not increase construction costs. It merely deals with the location of building elements that are already required by the Code.

Analysis: The last sentence of this proposal addresses interlocking/scissor stairways. There are other code changes dealing specifically with scissors stairways that will be heard by the IBC Means of Egress Committee.

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G65–07/08

403.15 (New), Chapter 35 (New)

Proponent: Michael Gardner, Gypsum Association

THIS PROPOSAL IS ON THE AGENDA OF THE IBC STRUCTURAL CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IBC STRUCTURAL CODE DEVELOPMENT COMMITTEE.

1. Add new text as follows:

403.15 Structural integrity of exit stairway enclosures and elevator shaft enclosures. For all buildings that are more than 420 feet (128 m) in height, exit stairway enclosures and elevator shafts enclosures shall comply with Sections 403.15.1 through 403.15.3.

403.15.1. Wall assembly. The wall assemblies making up the exit stairway enclosures and elevators shaft enclosures shall meet or exceed Soft Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.

403.15.2. Wall assembly materials. The face of the wall assemblies making up the exit stairway enclosures and elevator shaft enclosures that are not exposed to the interior of the exit stairway enclosure or elevator shaft enclosure shall be constructed in accordance with one of the following methods:

1. The wall assembly shall incorporate not less than two layers of impact-resistant construction board each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.
2. The wall assembly shall incorporate not less than one layer of impact-resistant construction material that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in

ASTM C1629/C1629M.

3. The wall assembly shall incorporate multiple layers of any material, tested in tandem, that meet or exceed Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

403.15.3. Other Wall Assemblies: An entire wall assembly that provides impact resistance equivalent to that required by Section 403.15.1.and the Hard Body Impact Classification Level 3 in ASTM C1629/C1629M shall be permitted.

2. Add standard to Chapter 35 as follows:

ASTM

C1629/C1629M-06 Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

Reason: The intent of this proposal is to incorporate a reference to ASTM Standard C 1629 into the code. The standard was developed through the ASTM process to directly address impact-resistance requirements for materials that could be incorporated into stair and elevator enclosures in high rise construction.

By incorporating the reference to ASTM C 1629 a definitive method of establishing criteria to assess the impact-resistance of stair and elevator enclosures will be incorporated into the code. This is in contrast to recent proposals that have attempted to inappropriately impose specific requirements of the ASTM E 119 standard onto enclosure systems or that have proposed other arbitrary performance requirements for enclosure systems.

While the standard was developed to specifically test gypsum and fiber-reinforced cement panels, it can readily be used to test the impact resistance of other board and panel materials. In addition, it establishes specific values for the impact resistance of materials that can be used as a benchmark for the evaluation of other materials and systems.

This proposal directly reflects recent action by the City of New York. In July 2006, Section 32-05 of Chapter 32 of Title 1 of the Rules of the City of New York was adopted by the City of New York. Section 32-05 established criteria for the evaluation of stair enclosures in office building construction in New York City by incorporating a reference to the ASTM C 1629 standard. Rule 32 also established performance criteria for systems constructed using other materials.

This proposal takes the language adopted by the City of New York and modifies it for use in the IBC. In so doing, it eliminates much of the prescriptive language contained in Section 32-05 of the New York City text. That is intentional since much of the prescriptive language contained in Section 32-05 appears in other sections of or is incorporated by reference into the IBC.

The proposed Section 403.15 establishes that the language will apply only to buildings that are more than 420 feet in height and only to the exit stairway and elevator enclosures within those buildings. This is more restrictive than the New York City language which imposes the impact resistant requirements onto all office buildings regardless of size or height.

Section 403.15.1. directly mimics the New York City language that requires the entire assembly to withstand an impact resistance of 195 lbf as measured by the ASTM C 1629 Soft Body Impact Test. The test method used in C 1629 is conducted in accordance with the ASTM E 695 test method which covers the measurement of the relative resistance of wall, floor, and roof construction to impact loading.

Section 403.15.2 requires the face of the system that is not exposed to the shaft – the outside face - to be protected by a material or materials that comply with a level of impact resistance as established by the ASTM C 1629 Hard Body Impact Test. To comply with the proposed language at least two layers of Level 2 material or one layer of Level 3 material must be incorporated into the system. Level 2 material must withstand a Hard Body impact of 100 lbf to comply with the standard. Level 3 material must withstand a Hard Body impact of 150 lbf to comply with the standard.

The same section also permits the use of a system composed of multiple layers of different materials provided the composite system can comply with a Level 3 Hard Body test. The same concept is contained in the New York City language.

Section 403.15.3. is intended to permit monolithic systems, such as those constructed of masonry or concrete, to be evaluated using an available test method that will permit a quantifiable comparison with the performance requirements established by the proposed language. This is a change from the New York City language which specifically allows the use of masonry or concrete walls, but makes no provisions for other monolithic systems such as those constructed of plaster or other similar materials.

Cost Impact: The code change proposal will increase the cost of construction

Analysis: A review of the standard proposed for inclusion in the code, ASTM C1629/C1629M, for compliance with ICC criteria for referenced standards given in Section 3.6. of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.

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G66–07/08

403.17

Proponent: Jeff Harper, Rolf Jensen and Associates

THIS PROPOSAL IS ON THE AGENDA OF THE IBC MEANS OF EGRESS CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IBC MEANS OF EGRESS CODE DEVELOPMENT COMMITTEE.

Revise as follows:

403.17 (Supp) Additional ~~Exit Stairway~~ means of egress. For buildings other than Group R-2 that are more than 420 feet (128 m) in height, one additional ~~exit stairway~~ means of egress meeting the requirements of ~~Section 1009 and 1020~~ Chapter 10 shall be provided in addition to the minimum number of exits required by section 1019.1. ~~The total width of any combination of remaining stairways with one stairway removed shall not be less than the total width required by Section 1005.1. Scissor stairs shall not be considered the additional exit stair required by this section.~~

Reason: The purpose of the proposed change is to put the requirement for additional egress beyond what is normally required by Chapter 10 into terms that are already defined and used within the context of the Code. The proposed change is justified in that it gives an AHJ a little more flexibility in what can be considered while at the same time reducing the overall construction cost and increasing design flexibility for super tall buildings.

The rationale cited by the submitters of G71-06/07 was mostly focused on providing a means to permit firefighting operations to continue while allowing a rapid, full building evacuation. However, the resulting code changes materially restrict the designer and the code official into a very specific design for buildings exceeding the 420 foot height. In reality, as the G71 submitter acknowledges, there are other alternatives to achieve the goals of firefighter operations occurring concurrently with building evacuation. The proposed language changes give the AHJ and designer a little more flexibility in the design, construction and operation rather than in dictating the design of buildings exceeding 420 feet.

Cost Impact: The code change proposal will not increase the cost of construction.

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G67–07/08
403.17

Proponent: Kim Clawson, Chicago Committee on High Rise Buildings, (CCHRB); David Frable, U.S. General Services Administration and David S. Collins, AIA, The Preview Group, Inc., representing the American Institute of Architects Codes and Standards Committee; Raymond A. Grill, PE, Arup, representing himself; Lawrence G. Perry, AIA, Building Owners and Managers Association (BOMA) International

THIS PROPOSAL IS ON THE AGENDA OF THE IBC MEANS OF EGRESS CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IBC MEANS OF EGRESS CODE DEVELOPMENT COMMITTEE.

Delete without substitution:

~~**403.17 (Supp) Additional exit stairway.** For buildings other than Group R-2 that are more than 420 feet (128 m) in height, one additional exit stairway meeting the requirements of Sections 1009 and 1020 shall be provided in addition to the minimum number of exits required by Section 1019.1. The total width of any combination of remaining stairways with one stairway removed shall not be less than the total width required by Section 1005.1. Scissor stairs shall not be considered the additional exit stair required by this section.~~

Reasons: Clawson: 1. The provisions in 403.17 requiring additional stairs causes significant additional cost to building construction with little or no demonstrated comparable increase in life safety. The additional costs consist both of the actual construction cost differences between construction of stair (versus a typical floor system); and the costs due to lost rentable and/or usable floor area that has been given over to stair area. It is essential to remember that zoning ordinances limit the total amount of square footage that can be constructed; and that there is no exemption from that total for area used for non-rentable purposes such as stairways.

2. The provision appears to be internally inconsistent with fire protection strategies: R-2 buildings are specifically exempt (presumably because of the use of protect-in-place strategy for those uses) but the provision does not address or accommodate the use of horizontal exits, which are essentially the same concept as protect-in-place.

3. The extreme event has not yet been well enough defined, to confirm that the addition of a third stair will add an significant additional level of protection, or a reasonably necessary level of protection.

4. The provision has been incorporated into the Code somewhat prematurely. There is a need to consider it in regard with other exiting issues that have been recently adopted or are under consideration within the life safety community.~~;~~ Some of these include a fire department elevator (adopted into the 2007 Supplement), the use of elevators for egress of occupants and for ingress of first responders; and increased exit capacity due to increases in the minimum widths of exit stairs. There is an essential need for all the issues related to exiting to be evaluated as a whole.

5. Implementation of the provision is based on the height of the building, not on the need as reflected in the occupant load of a building and its stairs. For instance, an office building with mall floor plates (10,000 gsf) would have the same requirement of three stairs as one with larger floor plates (such as 25,000 gsf).

Frable/Collins: The purpose of this code change proposal is to delete the subject text that currently requires all buildings other than Group R-2 that are more than 420 feet (128 m) in height to install one additional exit stairway.

During the 2006/2007 ICC Code Development Hearings in Orlando, the General Code Committee disapproved this code change proposal for the following reasons:

1. The NIST report was not yet complete, therefore the proposal was premature;
2. Modeling had not been done to show the extent that an additional exit stair would improve exiting;
3. The logistics for closing off an exit stair for fire department staging during an emergency evacuation must be investigated;
4. The calculation method for determining total exit width was confusing, and did not clearly indicate the width required for the additional

exit stair; and

5. The location of the additional exit stair in relationship to the other exit stairs and the elevators was not indicated.

At the Final Action Hearings of the ICC in May 2007, the ICC membership voted to overturn the General Code Committee's recommendation and approve the subject code change. At the Hearings, no new information was provided to address any of the General Committee's aforementioned concerns other than indicating that a NIST Report, NISTIR 7425 dated April 2007, *Accounting for Emergency Response in Building Evacuation: Modeling Differential Egress Capacity Solutions* was available at the back of the hearing room. According to proponents of the code change, the egress modeling conducted by NIST clearly demonstrated that the additional stair would improve occupant egress and firefighter access in buildings in all cases.

Based on our review of the subject NIST Report, it contains questionable technical information and numerous assumptions. In addition, it appears the egress modeling conducted by the NIST researchers to support the report cannot be reproduced for verification purposes and therefore in our opinion is inappropriate to be use as the only basis for this code change. For example:

1. The simplified egress simulation with a counter-flow sub-model was calibrated against only one evacuation drill observed in a 6 story office building having exit stairs 68 inches in width with 8 inch riser's heights and 11.1 inch tread depth's and having a very low building population. We would consider this to be atypical. All computer models need to be validated and be able to demonstrate numerous times repeatable results to ensure accuracy. Using data from only one low-rise building evacuation drill having a small population and extrapolating the data to taller buildings having much larger populations without validation is questionable and should not be used as technical substantiation for a code change of this magnitude.

2. The input data and assumptions used for the modeling scenario were not provided in the subject report for review. For example, total building population, occupant travel speed on level routes, occupant travel speed on stairs, floor rate through doors, floor rate on stairs, speed of slowest evacuee, number of exit door leaves available to evacuees, total length of route that is level, vertical distance moved via the stair, stair width (not effective flow width - report states clear width), stair riser height, stair tread depth, etc. were not provided in the report. Therefore, one cannot verify the results stated in the NIST report.

3. The modeling scenario assumes occupants within the exit stairs who are descending from floors located above the fire floor will immediately leave their exit stair, when that stair has been closed by the fire department, and transfer into nearest available stair. The General Code Committee believed that the logistics and time associated with the firefighters closing off an exit stair for fire department staging during an emergency evacuation must be investigated further. This concern was not addressed in the NIST report.

4. The modeling scenario assumes that the firefighters will not use the elevator. The General Code Committee believed that firefighters will typically use an elevator to get near the fire floor in lieu of using the exit stairs, so long as it is safe to use that elevator. This was particularly true since the code change to require a fire service access elevator was under consideration and was approved at the same hearings.

Another concern is with the statement that "scissor stairs shall not be considered an additional exit stair required by this section". As currently written, this statement implies that the exit capacity of a "scissor stair" cannot be utilized in determining the total required exit capacity of the building. This is at best unclear and sends an unreasonable message since the exit capacity of the "scissor stairs" would meet the intent and purpose of improving the building evacuation time.

We seriously question the need for an additional exit stair based on the fact that the IBC now requires a fire service access elevator in all buildings with an occupied floor more than 120 feet above the lowest level of fire department access. This new requirement not only provides a means for firefighters to quickly reach a location within the building one or two floors below the fire floor but also alleviates the impact of counter-flow raised by proponent's to substantiate the need for an additional exit stair.

Recommendation 17 from the NIST WTC report did not specifically require an additional exit stair, but recommended "tall buildings be designed to accommodate timely full building evacuation of occupants ….:" This recommendation does not discount the use of elevators or wider exit stairs, yet the proponents have stated that both are ineffective.

Last but not least, we feel the costs to construct the additional extra stair will significantly increase building construction and maintenance costs. For example, the difference between the cost of constructing 2 exit stairs having a nominal width of 44 inches versus constructing 3 exit stairs having a nominal width of 44 inches in a 42 story office building (504 feet in height) having 40,000 square foot per floor is over $1.3 million. In taller buildings the construction costs are even higher; for example the difference between the cost of constructing 2 exit stairs having a nominal width of 44 inches versus constructing 3 exit stairs having a nominal width of 44 inches in a 75 story office building (900 feet in height) having a 45,000 square foot per floor is over $2.3 million.

The bottom line is that it does not take a NIST report nor a rocket scientist to figure out that requiring additional exit stairs in buildings will improve the overall occupant evacuation times from a building. The bigger question that needs to be answered is - "at what economic cost to society is the ICC membership willing to incorporate these "so called" minimum requirements into the IBC." Other options may be available and all the ramifications of this new requirement have yet to be completely considered. It is our belief that with the new requirement for the installation of a fire service access elevator in tall buildings has increased the overall level of safety of the building occupants and fire fighters in a cost effective manner and therefore the need for an additional exit stair is not warranted.

Grill: The committee originally rejected this proposal for various reasons. The Committee statement made in support of disapproval follows. "Committee Reason: The committee felt that review of the NIST report was not yet complete, therefore this proposal was premature. Modeling should be done to show the extent that an additional stair would improve exiting. The logistics of closing off a stairway for fire department staging during an emergency evacuation must be investigated. The calculation method for exit stairway width was confusing, and did not clearly indicate the width required for the extra stairway. The location of the extra stairway in relation to the other exit stairways was not indicated. In a high rise, fire fighters will typically be using the elevator to get near the fire floor and then move to the stairway. A question would be if this stairway should be located near the elevators."

None of these concerns expressed in the committee rejection were addressed during the comment period. The requirement of a third stair to be provided and to not allow it to be considered as part of the egress capacity is overly restrictive. The justification for the proposal indicated that it implemented one of NIST's recommendations as a result of the WTC incident. Recommendation 17 from NIST's web site reads:

"Recommendation 17. NIST recommends that tall buildings be designed to accommodate timely full building evacuation of occupants when required in building-specific or large-scale emergencies such as widespread power outages, major earthquakes, tornadoes, hurricanes without sufficient advanced warning, fires, explosions, and terrorist attack. Building size, population, function, and iconic status should be taken into account in designing the egress system. Stairwell capacity and stair discharge door width38 should be adequate to accommodate counterflow due to emergency access by responders."

Note that NIST indicates that, "Building size, population, function, and iconic status should be taken into account in designing the egress system." The idea that adding a third totally redundant stair will make it easy for occupants to walk down 40 stories or

more or make it easy for first responders to walk up 40 stories or more doesn't make sense. As noted in NIST's Recommendation 17, tall buildings should be looked at on a case by case basis.

Perry: This proposal seeks to remove the requirement for an 'extra' exit stair in buildings over 420' in height that was added via a successful public comment at the Rochester Final Action Hearings.

The cost impacts, from initial construction cost to the lifetime costs due to less efficient building cores, were not considered by the proponent. The result of this change, should any local jurisdiction attempt to figure out how to apply it, would likely be to create a maximum building height of 420' in that jurisdiction. There has been no technical substantiation as to the need for this 'extra' stair, no rationale explaining the types of incidents this is supposed to protect from, and no cost/benefit analysis to show that the gain from this change, either for occupant egress or for fire department access times, will be worth the enormous costs.

The new provision is technically flawed in that it establishes a new means of egress requirement solely on a building height basis, and does not correlate the new requirement with application of the rest of Chapter 10. The result is a new requirement that would be interpreted in a wide variety of ways. The proposal adds an 'extra' stair, and requires it to comply with Section 1009 and 1020. Section 1009 provides the 'nuts and bolts' provisions for the stair, and Section 1020 provides the 'nuts and bolts' for the required enclosure. There is nothing in the new language that explains how to apply the remaining provisions of Chapter 10, most of which are based on a floor-by-floor approach to exiting. Examples of the unaddressed issues this new requirement raises:

- Travel distance. The new section requires a calculation assuming 'one stair removed'. Does this need to be satisfied for travel distance purposes as well, with the result being that two exits would always need to be within travel distance?
- Horizontal exits. It is unclear how this new provision would apply in buildings using a horizontal exit approach. Is there no additional requirement for a stair, or would buildings using a horizontal exit have to add a stair on either side of the horizontal exit?
- Scissor Stairs. The new text prohibits using a scissor stair as the 'extra stair'. This can be read to either prohibit scissors stairs from counting as any multiple exits, or allowing the 1019.1-calculated number of exit stairs to be scissor stairs, with the prohibition only applicable to the 'extra' stair.
- Access to Exits. There is nothing in the new text that creates a clear link to mandate that access to the 'extra' stair be provided on any individual floor. The text requires one to provide an extra stair, and then to calculate total required stair width with any one stair removed. Nothing requires providing access to anything other than the number of exits currently required by Section 1019.1.

Cost Impact: This code change will not increase the cost of construction.

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G68–07/08

403.18

Proponent: Tony Crimi, A.C. Consulting Solutions, Inc., representing the North American Insulation Manufacturer's Association (NAIMA)

THIS PROPOSAL IS ON THE AGENDA OF THE IBC FIRE SAFETY CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IBC FIRE SAFETY CODE DEVELOPMENT COMMITTEE.

Revise as follows:

403.18 (Supp) Sprayed fire-resistive materials (SFRM). The bond strength of the SFRM <u>installed throughout the building</u> shall be in accordance with Table 403.18.

Reason: To clarify the requirements in Section 403.18 (2007 Supplement) of the IBC in the previous cycle by proposal G68-06/07 on SFRM bond strength.

Because of the way that the new Table 403.18 is structured, there has been confusion regarding the interpretation of the SFRM bond strength requirements for buildings over 75 ft and 420 ft in height. This proposal intends to clarify that where the SFRM is installed, the bond strengths specified in 403.18 are required to be achieved throughout the height of the building, and not just on those portions of the building exceeding the heights specified in the Table.

Code change proposal G68-06/07 was submitted in the last cycle by the International Code Council Ad Hoc Committee on Terrorism Resistant Buildings. The purpose of this proposal was to increase the required adhesions of Spray Applied Fire Resistant Materials (SFRM). Recommendation 6 of the National Institute of Standards and Technology's (NIST) investigation Report into the World Trade Center (WTC) tragedy called for improvement of the in-place performance of SFRM. The Ad Hoc Committee on TRB demonstrated that these higher standards are warranted by the higher risk associated with taller buildings.

However, the language in Section 403.18 (2007 Supplement) has caused some confusion because it does not explicitly state that the higher bond strength material for <u>buildings over 75 feet</u> in height and for <u>buildings exceeding 420 feet</u> applies throughout those buildings. As an example, where SFRM is installed in a building which is 100 ft in height above the lowest level of fire department vehicle access, the SFRM is required to have a bond strength of 430 psf as specified by Table 403.18 throughout the height of the building, and not only on the uppermost 25 ft of building height.

This Code change clarifies the requirement for higher bond strength material for buildings over 75 feet in height and yet again higher strength for those that exceed 420 feet.

Bibliography: National Institute of Standards and Technology. Final Report of the National Construction Safety Team on the Collapses of the World Trade Center Towers. United States Government Printing Office: Washington, D.C. September 2005.

Cost Impact: The code change proposal will not increase the cost of construction.

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G69–07/08

403.18, Table 403.18

Proponent: David Frable, U.S. General Services Administration

THIS PROPOSAL IS ON THE AGENDA OF THE IBC FIRE SAFETY CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THE IBC FIRE SAFETY CODE DEVELOPMENT COMMITTEE.

Delete without substitution:

~~**403.18 (Supp) Sprayed fire-resistive materials (SFRM).** The bond strength of the SFRM shall be in accordance with Table 403.18.~~

~~TABLE 403.18 (Supp)~~
~~MINIMUM BOND STRENGTH~~

~~HEIGHT OF BUILDING~~[a]	~~SFRM MINIMUM BOND STRENGTH~~
~~More than 75 feet and up to 420 feet~~	~~430 psf~~
~~More than 420 feet~~	~~1,000 psf~~

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kW/m2~~
~~a. Above the lowest level of fire department vehicle access~~

Reason: The purpose of this code change proposal is to delete the subject text and Table that was "approved as modified" (G68-06/07) by the General Code Committee even though the Committee stated in their reason statement that no technical data has been provided to justify increasing the current IBC requirements for the minimum bond strength for SFRM in high-rise buildings. In addition, we feel that the proponents did not provided a logical explanation which clearly shows why the current Code provisions regarding the minimum bond strength for SFRM in high-rise buildings is inadequate and how this subject proposal will improve the level of overall safety to the building occupants. Inspectors for jurisdictions have acknowledged that the single most common reason for SFRM dislodgement during construction is the intentional removal of SFRM by trades for the purpose of attaching certain installations to the steel frame. Therefore, we do not see how Increasing the density or bond strength will resolve this issue. In addition, to our knowledge, there also has been no evidence submitted by any of the proponents to document the claim that building sway dislodges SFRM. Last but not least, it has come to our attention that there may have been misleading testimony regarding the cost impact for installing SFRM at these higher bond strengths. For example, based on independent government cost estimates; SFRM bond strength of 150 psi costs approximately $4.31 per gross square foot floor area; SFRM bond strength of 430 psi costs approximately $6.52 per gross square foot floor area; and SFRM bond strength of 1000 psi costs approximately $11.58 per gross square foot floor area. Based on these cost estimates, the increased cost for using a bond strength of 1000 psi versus 150 psi for a building 504 feet in height (42 stories) @ 40,000 square feet per floor would be over $12.2 million.

We strongly believe that mandating the increased "minimum" SFRM bond strengths for all high-rise buildings is unjustified and that this current code provision will significantly increase building construction costs in ALL high-rise buildings; without knowing if in fact, that increasing the SFRM minimum bond strengths will improve the level of overall safety to the building occupants.

Cost Impact: The code change proposal will not increase the cost of construction.

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G108–07/08

421 (New), Table 421.1 (New)

Proponent: Ronald O. Hamburger, SE, Simpson Gumpertz & Heger, Inc., representing the National Council of Structural Engineers Association Ad Hoc Joint Industry Committee on Structural Integrity

1. Add new text as follows:

SECTION 421
BUILDINGS REQUIRING A RISK ASSESSMENT

421.1 General. In addition to the other requirements of this code, buildings and other structures meeting the criteria indicated in Table 421.1 shall be in accordance with Sections 421.2 through 421.4.

TABLE 421.1
BUILDINGS AND OTHER STRUCTURES REQUIRING A RISK ASSESSMENT

1. Buildings more than 420 feet in height with an occupant load greater than 5,000.

2. Buildings and other structures with an occupant load greater than 10,000.
3. Buildings and other structures deemed by a jurisdiction to be at higher than normal risk of being subjected to acts characterized as terrorist threats.

421.2 Risk assessment. A risk assessment report performed by an approved agency with expertise in risk characterization for accidental and intentional hazards including terrorism threat and vulnerability assessment shall be provided to the building official. The assessment shall conform to generally accepted principles for risk analysis and follow industry guidelines for identifying and characterizing terrorism threats and evaluating vulnerability to extreme loads and events. Thorough documentation of the assessment, including assumptions, information sources, calculations and analyses, and referenced guidelines shall be submitted to the authority having jurisdiction for review and approval. Following acceptance of the risk assessment, the reports and other data submitted shall be returned to the building owner. Retention of these documents by the building official shall not be required.

421.3 Peer review. The building official is authorized to require an independent review of the risk assessment. The review shall be performed by one or more approved individuals with expertise in risk characterization for accidental and intentional hazards including terrorism threat and vulnerability assessment. The review shall include the assumptions used, the methods of analysis, and the findings. Upon completion of the review, the reviewer(s) shall submit a report to the building official, indicating the scope of review performed and the findings of that review.

421.4 Mitigation. Risks identified in the risk assessment shall be mitigated in an approved manner. Acceptable mitigation shall include measures to reduce the risk, or the acceptance of the risk as reasonable or unavoidable.

Reason: This proposal was developed by a broad industry coalition that included participation by the National Council of Structural Engineering Associations, the Structural Engineering Institute of the American Society of Civil Engineers, the American Institute of Architects, the American Concrete Institute, the American Forest & Paper Association, the American Iron and Steel Institute, the American Institute of Steel Construction, the Masonry Alliance for Codes and Standards, The Masonry Society, the Portland Cement Association, the Steel Joist Institute, the Precast/Prestressed Concrete Institute. Corresponding members included the International Code Council and the National Fire Protection Association. In addition, there was nonvoting participation by the National Institute of Building Sciences, and the National Institute of Standards and Technology.

The terrorist attacks on Oklahoma City's Alfred P. Murrah Building, New York's World Trade Center and the Pentagon have made it clear that persons and groups with political agendas, both domestic and foreign, will attempt attacks against government and financial centers, and iconic and other buildings and structures that will render a graphic and large statement about their causes. Federal agencies, as well as many state and local governments and some private developers have adopted policies of requiring new buildings and structures to be constructed with safeguards against possible attacks. These safe guards take many forms and include such things as siting, enhanced structural design requirements, increased security including access restrictions, monitoring, and inspections; and protection of ventilation systems, to name just a few.

In developing this proposal, the coalition was confronted with the many difficulties associated with setting prescriptive minimum criteria for the design of buildings to protect against attack. Not the least of these is that terrorists are clever and quite capable of developing weapons and methods of attack that are capable of overwhelming any prescriptive criteria placed in building codes or otherwise maintained in the public record. The second is that the factors and characteristics that place a particular building at higher risk of attack than other structures are complex and vary greatly from community to community and even from neighborhood to neighborhood

Recognizing this, many government agencies and some private owners have resorted to building-specific risk assessments as a means of identifying appropriate protective measures for individual buildings and structures. These risk assessments might take into consideration a wide assortment of factors such as the location of the building, its occupancy and function, the ownership, the tenants, the site, the surrounding community, and the architectural design. The risks considered within the assessment may go well beyond code prescribed risks and include such risks as intentional attacks with weapons, collateral effects of attacks on neighboring properties, accidental explosions, biological or chemical attacks, car/truck/train impact and other low-probability events. Commonly included with a risk assessment is a recommended program of strategies that are deemed appropriate to reduce the effect of the assessed risks. For some risks addressed in the assessment an appropriate strategy may be to take accept the risk without further action, due to the cost or other unfavorable consequences of attempting to reduce the risk.

This proposal requires such risk assessments for those few structures that could be a target of attack in any community due to their size (over 420 feet in height and an occupant load greater than 5,000) or large occupant load (an occupancy load greater than 10,000). It also provides the opportunity for building officials and other authorities having jurisdiction to designate those special structures, which in their communities, also could be potential targets of attack. The proposal does not specify specific protective measures. Rather, it is intended that the design team, owner and building official will work in a collaborative manner to identify those risks that are significant to the particular building or structure and to take appropriate measures to mitigate these risks.

The proposal requires that documentation of the risk assessment, upon completion and acceptance be returned to the building owner, who may at his discretion, destroy these, so that a public record does not exist of the design criteria, and hence so that terrorists may not have access to the design basis for a building or identification of its vulnerabilities.

Cost Impact: For the overwhelming majority of buildings and structures, this proposal will have no impact on cost. For those relatively few buildings and structures that are designated as requiring a risk assessment, the cost of the assessment itself will result in a small increase in design costs. To the extent that mitigation measures are identified and included in the design, it will increase construction costs, to an extent that will be different for each affected structure.

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G193–07/08
3007, 403.10, [F] 903.3.1.1.1 (IFC 903.3.1.1.1)

Proponent: Ed Donoghue, Edward Donoghue Associates Inc. (EADAI)

Revise as follows:

SECTION 3007 (Supp)
~~FIRE SERVICE ACCESS~~ ROBUST FIRE SERVICE ELEVATOR

3007.1 (Supp) General. Where required by Section 403.10, every floor of the building shall be served by a ~~fire service access~~ robust fire service elevator. Except as modified in this section, the ~~fire service access~~ robust fire service elevator shall be installed in accordance with this chapter and ASME A17.1.

3007.2 (Supp) Hoistway enclosures protection. The ~~fire service access~~ robust fire service elevator shall be located in a shaft enclosure complying with Section 707.

3007.3 (Supp) ~~Fire service access~~ Robust fire service elevator lobby. The ~~fire service access~~ robust fire service elevator shall open into a ~~fire service access~~ robust fire service elevator lobby in accordance with Sections 3007.3.1 through 3007.3.3.

> **Exception:** Where a ~~fire service access~~ robust fire service elevator has two entrances onto a floor, the second entrance shall be permitted to open into an elevator lobby in accordance with Section 707.14.1.

3007.3.1 (Supp) Access. The ~~fire service access~~ robust fire service elevator lobby shall have direct access to an exit enclosure.

3007.3.2 (Supp) Lobby enclosure. The ~~fire service access~~ robust fire service elevator lobby shall be enclosed with a smoke barrier having a minimum 1-hour fire-resistance rating, except that lobby doorways shall comply with Section 3007.3.3.

> **Exception:** Enclosed ~~fire service access~~ robust fire service elevator lobbies are not required at the street floor.

3007.3.3 (Supp) Lobby doorways. Each ~~fire service access~~ robust fire service elevator lobby shall be provided with a doorway that is protected with a 3/4-hour fire door assembly complying with Section 715.4.

3007.4 (Supp) Standpipe hose connection. A Class I standpipe hose connection in accordance with Section 905 shall be provided in the exit enclosure having direct access from the ~~fire service access~~ robust fire service elevator lobby.

3007.5 (Supp) Elevator system monitoring. The ~~fire service access~~ robust fire service elevator shall be continuously monitored at the fire command center by a standard emergency service Interface system meeting the requirements of NFPA 72.

3007.6 (Supp) Electrical power. The following features serving each ~~fire service access~~ robust fire service elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Elevator machine room ventilation and cooling equipment.
3. Elevator controller cooling equipment.

3007.6.1 (Supp) Protection of wiring or cables. Wires or cables that provide normal and standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to ~~fire service access~~ robust fire service elevators shall be protected by construction having a minimum 1-hour fire-resistance rating or shall be circuit integrity cable having a minimum 1-hour fire-resistance rating.

403.10 (Supp) ~~Fire service access~~ Robust fire service elevator. In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, a minimum of one ~~fire service access~~ robust fire service elevator shall be provided in accordance with Section 3007.

[F] 903.3.1.1.1 (IFC 903.1.1.1) Exempt locations. Automatic sprinklers shall not be required in the following rooms or areas where such rooms or areas are protected with an approved automatic fire detection system in accordance with Section 907.2 that will respond to visible or invisible particles of combustion. Sprinklers shall not be omitted from any room merely because it is damp, of fire-resistance rated construction or contains electrical equipment.

1. Any room where the application of water, or flame and water, constitutes a serious life or fire hazard.
2. Any room or space where sprinklers are considered undesirable because of the nature of the contents, when approved by the fire code official.
3. Generator and transformer rooms separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire-resistance rating of not less than 2 hours.
4. Rooms or areas that are of noncombustible construction with wholly noncombustible contents.
5. ~~Fire service access~~ robust fire service elevator machine rooms and machinery spaces.

Reason: This particular change is intended to change the terminology from "Fire Service Access Elevator" as used in Section 3007 and related referenced sections to "Robust Fire Service Elevator". The basis for this change is related to the fact that elevators in all buildings have some level of fire service access associated with them with the requirements for Phase I recall and Phase II emergency operation. Therefore the current terminology does not highlight the enhanced features that the requirements in Section 3007 provide.

Background. As a result of the September 11, 2001 attacks on the World Trade Center, code provisions for emergency egress from tall buildings are being re-examined. There is renewed interest in the use of elevators for both occupant egress and fire fighters access. Therefore a Workshop on the Use of Elevators in Fires and Other Emergencies was held March 2-4, 2004, in Atlanta, Georgia. The workshop was cosponsored by American Society of Mechanical Engineers (ASME International), National Institute of Standards and Technology (NIST), International Code Council (ICC), National Fire Protection Association (NFPA), U.S. Access Board, and the International Association of Fire Fighters (IAFF).

The workshop focused on two general topics:
(1) Use of Elevators by Fire fighters and
(2) Use of Elevators by Occupants during Emergencies

To follow up on the ideas generated at the workshop, 2 task groups were formed; one for each topic. Their goals are:

- Review the suggestions from the Workshop on the Use of Elevators in Fires and other Emergencies.
- Develop a prioritized list of issues.
- Conduct a hazard analysis of the prioritized list of issues to see if there are any residual hazards.
- Draft code revisions for those issues that survive the process and the task group members still want addressed.

The membership of these task groups is broad and includes representatives from the elevator industry and manufacturers of devices such as fire alarms, the fire service, model codes and standards development organizations, and the accessibility community as well as fire protection engineers, architects and specialists in human factors and behavior. Since February 2005 the groups have each been conducting a hazard analysis on their assigned topic. The results of the hazard analysis focused upon the fire fighter needs is nearing completion.

The task group studied 16 different cases. In these cases a particular hazard followed by a cause/trigger was reviewed. The result of the hazard interacting with cause/trigger events may create a particular incident/effect. To address possible incident/effects corrective actions are proposed. Such corrective actions are then reviewed to see if they create any residual hazards. The hazard analysis then carries out each of the residual hazards with additional corrective actions until the hazard is mitigated. It is strictly a hazard analysis (I.e. not probabilistic) and certain assumptions were made such as a single fire start in a high rise building. The following link provides a summary of the cases reviewed for the fire service elevator hazard analysis (PROVIDE LINK).

The code changes generated by this analysis are related both to the summary of corrective actions resulting from the hazard analysis and the existing language related to fire service access elevators placed into the 2007 Supplement.

These proposals will work with the 2007 supplement requirements for fire service access elevators to address these concerns. It should be noted that the hazard analysis assumed a lobby to be directly connected with the fire service access elevator thus making the result of the analysis consistent with the philosophical approach found in the 2007 Supplement.

Cost Impact: The code change proposal will not increase the cost of construction.

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G194–07/08

3007.2

Proponent: Greg Lake, Sacramento Metropolitan Fire District, representing the California Fire Chiefs Association (Cal Chiefs)

Revise as follows:

3007.2 (Supp) Hoistway enclosures protection. The fire service access elevator shall be located in a shaft enclosure complying with Section 707. <u>The fire-resistance rating of the fire service access elevator hoistway enclosure walls shall be determined by meeting the conditions of acceptance specified in ASTM E119 with the hose stream test conducted at the end of the fire test for the original test specimen to determine the integrity of the wall.</u>

Reason: Cal Chiefs has decided to submit this code change proposal as a result of discussions which occurred during the Public Hearings held at the ICC Final Action Hearings on Code Change Proposals G70-06/07 submitted by the Masonry Alliance for Codes and Standards (MACS) and G73-06/07 submitted by the Ad Hoc Committee on Terrorism Resistant Buildings to address the issue of the physical integrity of elevator hoistway and exit stairway shaft enclosures in super high rise buildings (those buildings greater than 420 in height). Both code changes received significant debate but were subsequently disapproved. However, the Class A voting membership was able to successfully overturn the Committee's recommendation for disapproval of Code Change G70-06/07 but was unsuccessful in achieving the necessary two-thirds majority vote for approval of the code change. We believe that code change had merit so we reviewed it and revised it to better clarify it and make it more enforceable in our opinion based on this code change submittal.

It is clear in the NIST Final Report of the National Construction Safety Team on the collapse of the World Trade Center Towers which can be found on the NIST website at www.NIST.gov that there is a need to provide a means for determining minimum structural integrity criteria for the means of egress in very tall buildings which may include elevator hoistways for elevators that may be used for emergency access by emergency responders, or as a method of emergency evacuation, especially for people with disabilities. Recommendation 18 in Chapter 9 of the NIST Report stated the following:

"NIST recommends that egress systems (i.e. stairs, elevators, exits) should be designed … (2) to maintain their functional integrity and survivability under foreseeable building-specific or large-scale emergencies…"

Item B in this recommendation further states:

"The design, functional integrity, and survivability of the egress and other life safety systems, (e.g., stairwell and elevator shafts…) should be enhanced by considering accidental structural loads such as those induced by overpressures (e.g., gas explosions), impacts, or major hurricanes and earthquakes, in addition to fire separation requirements… The stairwells and elevators shafts… should have adequate structural integrity to withstand accidental structural loads and anticipated risks."

In other words, the exit stairway shaft enclosures should be "hardened" beyond what they may be today based on the fire tests currently prescribed in ASTM E119.

We believe that the most direct and effective approach at this time based on the use of nationally recognized standards to determine the structural integrity of the exit stairway shaft enclosure walls is to specify that when the fire-resistance rating for the wall assembly is determined in accordance with ASTM E119, that it is based on the hose stream test portion of the test being conducted at the end of the fire-resistance test for the original test specimen. That is one of three options prescribed in ASTM E119 for when the hose stream test is to be applied. Another option for applying the hose stream test for wall assemblies having a fire-resistance rating of 1-hour or more is to test a second test specimen for one-half the duration of the fire-resistance rating determined by the original test specimen but for not more than 1-hour and then apply the hose stream test. So for a 2-hour fire-resistance rated wall which would be required for these shaft enclosures, the hose stream test under that option would be applied after a 1-hour fire-resistance test has been conducted on a duplicate test specimen of the original 2-hour fire-resistance rated wall assembly. It is obvious to us that if we specify the hose stream test to be conducted at the end of the fire-resistance test for the original test specimen, the wall must be substantially more robust and "hardened" in order to withstand the "impact, erosion, and cooling effects of a hose stream" as specified in Section 11.1 of ASTM E119. The purpose of the hose stream test is also explained in Appendix X5 Commentary to ASTM E119. Section X5.9 Integrity states: "In this hose stream test, the ability of the construction to resist disintegration under adverse conditions is examined."

As representatives of the fire service, we are very concerned that the elevator hoistway enclosures in these very tall buildings be sufficiently "hardened" to assure that they will withstand various impacts and stresses that may occur during an uncontrolled fire. This is especially important since we may be utilizing the elevators to assist in evacuation of the occupants of the building. In the NIST Report it was estimated that the evacuation of a fully occupied World Trade Center Tower would have taken approximately 4 hours. And, of course, we may need to deal with evacuation of disabled occupants utilizing these elevators as well. Also, the responding fire department may also utilize these elevators to gain access to the fire floor since the stairways may not be practical. It was also noted in the NIST Report that it was estimated that the fire department response using the stairways to gain access to the 58th floor of a hypothetical 60 story building for fire fighting operations and rescue purposes would require at least 90 minutes provided the fire department personnel were not carrying any equipment or breathing apparatus but could take as much as 120 minutes if the emergency responders were in fact carrying equipment and breathing apparatus.

Since the fire service will be relying on the fire service access elevator to move their man power and equipment up into the building to the fire floor immediately below the fire floor in these high rise buildings, it is essential that they have adequate structural integrity to withstand an uncontrolled fire exposure which may subject the hoistway enclosure walls to unusual stresses and physical impacts by falling objects and debris, etc. We need some very firm assurances that the hoistway enclosure integrity will be maintained so that we can reasonably safely use the elevator for our emergency fire fighting purposes. Based on our understanding of how the hose stream test is applied ASTM E119 and our observation of its application to different fire-resistance rated 2-hour assemblies, we would feel much better utilizing fire service access elevators in a hoistway enclosure protected as prescribed by this code change proposal.

In conclusion, Cal Chiefs strongly supports the need to "harden" the elevator hoistway enclosures in these super high rise buildings in order to provide adequate fire and life safety for not only the occupants of the building but also for the responding fire department and other emergency personnel who may be using those elevators to gain access to the fire floor, as well as to assist in evacuation of the occupants. We believe that this code change proposal will provide that additional degree of integrity for "hardening" these elevator hoistway enclosures.

Cost Impact: This code change will increase the cost of construction.

Analysis: The 2007 Supplement includes a new section 3007, Fire Service Access Elevators. The requirement is scoped in Section 403.10.

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G195–07/08

3007.3 (New), 3007.6

Proponent: Ed Donoghue, Edward Donoghue Associates Inc. (EADAI)

1. Add new text as follows:

3007.3 (Supp) Hoistway lighting. The entire hoistway shall be illuminated at not less than 1 foot-candle (11 lux) at each hoistway entrance when firefighters' emergency operation is active.

(Renumber subsequent sections)

2. Revise as follows:

3007.6 (Supp) Electrical power. The following features serving each fire service access elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Elevator hoistway lighting

~~2.~~ 3. Elevator machine room ventilation and cooling equipment.
~~3.~~ 4. Elevator controller cooling equipment.

Reason: The focus of this proposal was upon providing illumination to assist fire fighters as they to advance up into the building. The prescribed procedure before leaving the designated level (DL), is to shine a light up into the hoistway to try and detect smoke, flame or water above them. They will repeat this step every 5 floors until they safely arrive at their staging floor, which is two floors below the lowest reported floor in alarm. By having hoistway lighting this will make their life safety maneuver much more effective.

Background. As a result of the September 11, 2001 attacks on the World Trade Center, code provisions for emergency egress from tall buildings are being re-examined. There is renewed interest in the use of elevators for both occupant egress and fire fighters access. Therefore a Workshop on the Use of Elevators in Fires and Other Emergencies was held March 2-4, 2004, in Atlanta, Georgia. The workshop was cosponsored by American Society of Mechanical Engineers (ASME International), National Institute of Standards and Technology (NIST), International Code Council (ICC), National Fire Protection Association (NFPA), U.S. Access Board, and the International Association of Fire Fighters (IAFF).

The workshop focused on two general topics:
(1) Use of Elevators by Fire fighters and
(2) Use of Elevators by Occupants during Emergencies

To follow up on the ideas generated at the workshop, 2 task groups were formed; one for each topic. Their goals are:

- Review the suggestions from the Workshop on the Use of Elevators in Fires and other Emergencies.
- Develop a prioritized list of issues.
- Conduct a hazard analysis of the prioritized list of issues to see if there are any residual hazards.
- Draft code revisions for those issues that survive the process and the task group members still want addressed.

The membership of these task groups is broad and includes representatives from the elevator industry and manufacturers of devices such as fire alarms, the fire service, model codes and standards development organizations, and the accessibility community as well as fire protection engineers, architects and specialists in human factors and behavior. Since February 2005 the groups have each been conducting a hazard analysis on their assigned topic. The results of the hazard analysis focused upon the fire fighter needs is nearing completion.

The task group studied 16 different cases. In these cases a particular hazard followed by a cause/trigger was reviewed. The result of the hazard interacting with cause/trigger events may create a particular incident/effect. To address possible incident/effects corrective actions are proposed. Such corrective actions are then reviewed to see if they create any residual hazards. The hazard analysis then carries out each of the residual hazards with additional corrective actions until the hazard is mitigated. It is strictly a hazard analysis (I.e. not probabilistic) and certain assumptions were made such as a single fire start in a high rise building.

The code changes generated by this analysis are related both to the summary of corrective actions resulting from the hazard analysis and the existing language related to fire service access elevators placed into the 2007 supplement.
These proposals will work with the 2007 supplement requirements for fire service access elevators to address these concerns. It should be noted that the hazard analysis assumed a lobby to be directly connected with the fire service access elevator thus making the result of the analysis consistent with the philosophical approach found in the 2007 Supplement.

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: The 2007 Supplement includes a new section 3007, Fire Service Access Elevators. The requirement is scoped in Section 403.10.

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G196–07/08

3007.3.3, 3007.3.3.1 (New)

Proponent: Gregory J. Cahanin, Cahanin Fire and Code Consulting, representing the Smoke Safety Council

Revise as follows:

3007.3.3 Lobby doorways. Each fire service access elevator lobby shall be provided with a doorway that is protected
with a $^{3}/_{4}$-hour fire door assembly complying with Section 715.4.

3007.3.3.1 Fire doors. Fire door assemblies shall meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784 without an artificial bottom seal installed across the full width of the bottom of the door assembly during the test. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot [ft3/(min × ft2)](0.015424 m3/ s × m2) of door opening at 0.10 inch (24.9 Pa)of water column for both the ambient temperature and elevated temperature tests. Louvers shall be prohibited. Installation of smoke doors shall be in accordance with NFPA 105.

Reason: This revision to lobby doorways as a part of the newly approved Fire Service Access Elevator requirements brings consistency with the door specification requirements found in the code. While the 715.4 reference now in this new section will lead many to believe that 715.4.3.1 is to be applied; the language of 715.4 states that doors conforming to 715.4.1, 715.4.2 or 715.4.3 are approved.

Provisions added to the IBC in the last cycle establish a Fire Service Access Elevator that will operate through a fire event for the use of firefighters and occupants that are rescued from upper floors due to mobility impairments or by virtue of being trapped by the fire on upper floors. Sections 715.4.3.1 in the code provide more complete prescriptive requirements for the doors behind which occupants and firefighters may seek refuge.

Doors which are utilized to protect occupants and rescue personnel for extended periods of time will be challenged by smoke spread on a fire floor that is impacted by the size of the fire, the presence or absence of building ventilation on the fire floor, stack effect, and wind load upon the building. The UL 1784 test allows for testing with or without an artificial bottom seal, with the use of duct tape being the typical mode of providing an artificial bottom seal during testing. Doors which have been tested to UL 1784 without taping of the bottom of the door and passed the leakage requirements mirror possible smoke impact that will be experienced during a fire better provide for the safety of firefighters and occupants staying in the Fire Service Access Elevator lobby for extended periods of time.

Cost Impact: There is no cost impact.

Public Hearing: Committee:	AS		AM	D
Assembly:		ASF	AMF	DF

G197–07/08
3007.3.4 (New)

Proponent: Ken Kraus, Los Angeles Fire Department, CA

Add new text as follows:

3007.3.4 Lobby size. Each fire service access elevator lobby shall be a minimum of 150 square feet (14 m^2) in area. The lobby shall increase in size by 50 square feet (4.65 m^2) for each additional elevator car served.

Reason: The purpose of this change is to enhance the efficacy of provisions recently added to the IBC as G63-06/07.

Stipulating a minimum size for the fire service elevator lobby is essential to ensure the effectiveness of the intended use. Areas used as a basis for firefighting emergency operations must be able to accommodate; multiple fire attack teams, tactical equipment, practical use of the associated standpipe, and do not conform to standard occupancy factor calculations.

A minimum size is also necessary to; ensure the effective utilization of the associated exit enclosure.

Without this change, design constraints, egress configuration limitations and other factors could dictate or limit the size of the lobby rendering it potentially useless.

Cost Impact: This code change proposal will increase the cost of construction.

Analysis: The 2007 Supplement includes a new section 3007, Fire Service Access Elevators. The requirement is scoped in Section 403.10.
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G198–07/08
3007.5 (New)

Proponent: Ed Donoghue, Edward Donoghue Associates Inc. (EADAI)

Add new text as follows:

3007.5 Alternative machine room ventilation. Where machine rooms are ventilated utilizing supply air from outside the machine room, an alternative ventilation supply shall be provided in accordance with Section 3007.5.1 and 3007.5.2.

3007.5.1 System response. Upon activation of a smoke damper located in the supply duct in accordance with Section 3007.5.2 the supply intake for the machine room ventilation system shall transfer to a secondary supply intake remote from the primary supply intake. Upon activation of the smoke damper located in the secondary supply duct in accordance with Section 3007.5.2 the system shall shut down and the air within the machine room shall be re-circulated.

3007.5.2 Smoke dampers. Smoke dampers shall be located downstream of any filters in the primary and secondary air intake for the machine room ventilation. Installation of smoke dampers shall be in accordance with Section 716.

(Renumber subsequent sections)

Reason: It is imperative that the elevator system serving the Robust Fire Service Elevators (RFSE) remain operational for as long as possible. One method to insure this is to provide an environment conducive to continued mechanical/electrical operation of the elevator equipment located in the elevator machine rooms, control rooms and control spaces.

This proposal adds a second backup air supply provided from an alternate source, and in the event both external sources are contaminated as evidenced by activation of smoke dampers in both the primary supply as well as the secondary supply ducts, the air in the machine room will be recirculated with no make up air added.

Failure to maintain extended operational reliability to the elevators (RFSE) used by the Fire Service could result in sudden unanticipated failure resulting in both Firefighters (potentially along with disabled building occupants) trapped in stalled elevator cabs. This would necessitate rescue by other fire fighters thereby diminishing resources available to fight the fire.

Background. As a result of the September 11, 2001 attacks on the World Trade Center, code provisions for emergency egress from tall buildings are being re-examined. There is renewed interest in the use of elevators for both occupant egress and fire fighters access. Therefore a Workshop on the Use of Elevators in Fires and Other Emergencies was held March 2-4, 2004, in Atlanta, Georgia. The workshop was cosponsored by American Society of Mechanical Engineers (ASME International), National Institute of Standards and Technology (NIST), International Code Council (ICC), National Fire Protection Association (NFPA), U.S. Access Board, and the International Association of Fire Fighters (IAFF).

The workshop focused on two general topics:

(1) Use of Elevators by Fire fighters and

(2) Use of Elevators by Occupants during Emergencies

To follow up on the ideas generated at the workshop, 2 task groups were formed; one for each topic. Their goals are:

- Review the suggestions from the Workshop on the Use of Elevators in Fires and other Emergencies.
- Develop a prioritized list of issues.
- Conduct a hazard analysis of the prioritized list of issues to see if there are any residual hazards.
- Draft code revisions for those issues that survive the process and the task group members still want addressed.

The membership of these task groups is broad and includes representatives from the elevator industry and manufacturers of devices such as fire alarms, the fire service, model codes and standards development organizations, and the accessibility community as well as fire protection engineers, architects and specialists in human factors and behavior. Since February 2005 the groups have each been conducting a hazard analysis on their assigned topic. The results of the hazard analysis focused upon the fire fighter needs is nearing completion.

The task group studied 16 different cases. In these cases a particular hazard followed by a cause/trigger was reviewed. The result of the hazard interacting with cause/trigger events may create a particular incident/effect. To address possible incident/effects corrective actions are proposed. Such corrective actions are then reviewed to see if they create any residual hazards. The hazard analysis then carries out each of the residual hazards with additional corrective actions until the hazard is mitigated. It is strictly a hazard analysis (I.e. not probabilistic) and certain assumptions were made such as a single fire start in a high rise building.

The code changes generated by this analysis are related both to the summary of corrective actions resulting from the hazard analysis and the existing language related to fire service access elevators placed into the 2007 Supplement.

These proposals will work with the 2007 Supplement requirements for fire service access elevators to address these concerns. It should be noted that the hazard analysis assumed a lobby to be directly connected with the fire service access elevator thus making the result of the analysis consistent with the philosophical approach found in the 2007 Supplement.

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: The 2007 Supplement includes a new section 3007, Fire Service Access Elevators. The requirement is scoped in Section 403.10.
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G199–07/08
3007.6.1

Proponent: Ed Donoghue, Edward Donoghue Associates Inc. (EADAI)

Revise as follows:

3007.6.1 (Supp) Protection of wiring or cables. Wires or cables that provide normal and standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to fire service access elevators shall be protected by construction having a minimum ~~1~~ <u>2</u>-hour fire-resistance rating or shall be circuit integrity cable having a minimum ~~1~~ <u>2</u>-hour fire-resistance rating.

<u>**Exception:** Wire and cables inside 2 hour fire-resistance rated machine rooms and hoistways shall not require fire-resistance rating.</u>

Reason: The safety of the firefighters during their firefighting operations is dependent upon the life safety support systems (listed above) being maintained during the critical first 2 hours of their efforts. Locating, surrounding and extinguishing the fire, as well as removing those lives in jeopardy, will take time. Those activities cannot be run while looking at their watches to determine if that "hour" is nearly up. If they have not gotten the fire under control by 2 hours into the effort, then it is probably time to evacuate. Providing the 2 hour protection will provide the necessary safety factor for fire fighters to undertake fire fighting and rescue operations without increased concern for system failure.

Background. As a result of the September 11, 2001 attacks on the World Trade Center, code provisions for emergency egress from tall buildings are being re-examined. There is renewed interest in the use of elevators for both occupant egress and fire fighters access. Therefore a Workshop on the Use of Elevators in Fires and Other Emergencies was held March 2-4, 2004, in Atlanta, Georgia. The workshop was cosponsored by American Society of Mechanical Engineers (ASME International), National Institute of Standards and Technology (NIST), International Code Council (ICC), National Fire Protection Association (NFPA), U.S. Access Board, and the International Association of Fire Fighters (IAFF).

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- Review the suggestions from the Workshop on the Use of Elevators in Fires and other Emergencies.
- Develop a prioritized list of issues.
- Conduct a hazard analysis of the prioritized list of issues to see if there are any residual hazards.
- Draft code revisions for those issues that survive the process and the task group members still want addressed.

The membership of these task groups is broad and includes representatives from the elevator industry and manufacturers of devices such as fire alarms, the fire service, model codes and standards development organizations, and the accessibility community as well as fire protection engineers, architects and specialists in human factors and behavior. Since February 2005 the groups have each been conducting a hazard analysis on their assigned topic. The results of the hazard analysis focused upon the fire fighter needs is nearing completion.

The task group studied 16 different cases. In these cases a particular hazard followed by a cause/trigger was reviewed. The result of the hazard interacting with cause/trigger events may create a particular incident/effect. To address possible incident/effects corrective actions are proposed. Such corrective actions are then reviewed to see if they create any residual hazards. The hazard analysis then carries out each of the residual hazards with additional corrective actions until the hazard is mitigated. It is strictly a hazard analysis (I.e. not probabilistic) and certain assumptions were made such as a single fire start in a high rise building.

The code changes generated by this analysis are related both to the summary of corrective actions resulting from the hazard analysis and the existing language related to fire service access elevators placed into the 2007 Supplement.

These proposals will work with the 2007 Supplement requirements for fire service access elevators to address these concerns. It should be noted that the hazard analysis assumed a lobby to be directly connected with the fire service access elevator thus making the result of the analysis consistent with the philosophical approach found in the 2007 Supplement.

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: The 2007 Supplement includes a new section 3007, Fire Service Access Elevators. The requirement is scoped in Section 403.10.
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G200–07/08
3007.7 (New)

Proponent: Ed Donoghue, Edward Donoghue Associates Inc. (EADAI)

Add new text as follows:

<u>**3007.7 Protection from water.** The fire service access elevator lobby and hoistway shall be protected from the intrusion of water from sprinklers in accordance with Sections 3007.7.1 through Section 3007.7.5.</u>

<u>**3007.7.1 Lobby entrance.** The floor outside the entrance to the fire service access elevator lobby shall be sloped in order to prevent water from entering the lobby at a minimum of 1 percent toward a drain outside of the lobby with the capacity to drain the discharge water from not less than two sprinklers discharging simultaneously.</u>

<u>**3007.7.2 Hoistway entrance.** The Fire Service access elevator hoistway entrance shall be protected from the intrusion of water in accordance with Section 3007.7.2.1 and 3007.7.2.2</u>

<u>**3007.7.2.1 Drains.** Water shall be diverted from entering the hoistway through the hoistway entrance using one of the following methods.</u>

1. A trench drain placed in the floor at the hoistway entrance; or
2. The lobby floor is sloped in order to prevent water from entering the hoistway away from the hoistway entrance at a minimum of 1 percent and leading to a drain.

Floor drains and trench drains shall have the capacity to drain the discharge water from not less than two sprinklers that are closest to the hoistway and discharging simultaneously.

3007.7.2.2 Gasketed barriers. Gasketed barriers, designed to act as water doors, shall be designed and installed to separate the hoistway entrance from the lobby when a sprinkler in the lobby has activated. The barriers shall be designed such that a fire fighter can view and access the lobby area.

3007.7.3 Hoistway walls. Walls forming the fire service access elevator hoistway shall be protected from the intrusion of water by one of the following methods.
1. Trench drains placed in the floor around the perimeter;
2. Floors sloped away from the hoistway walls at a minimum of 1 percent and leading to drains; or
3. Curbs or dams above a floor to a height of 4 inches (102 mm) minimum.

Floor drains and trench drains shall have the capacity to drain the discharge water from not less than two sprinklers discharging simultaneously.

3007.7.4 Tripping hazards. Any drains or gaskets shall be arranged such that the tops are substantially flush with the floor surface elevation to avoid tripping hazards.

3007.8 Water protection. Sprinklers shall be prohibited in fire service access elevators hoistways and machine rooms.

Exception: Sprinklers installed in the elevator pit not greater than 2 feet (610 mm) above the pit floor.

Reason: This particular proposal focuses on keeping water from fire sprinklers from disabling the elevators the firefighters will use. With current building designs, sprinkler water that accumulates on the floor tends to drain through the elevator hoistways and stairwells. In order to keep the elevators operational, the electric circuits on the car and in the hoistway must be kept dry. The Hazard Analysis considered outdoor elevator equipment, but concluded that the best way to do this is to prevent the water from entering the hoistway in the first place. This is done by directing the water to drains designed for that purpose.

Background. As a result of the September 11, 2001 attacks on the World Trade Center, code provisions for emergency egress from tall buildings are being re-examined. There is renewed interest in the use of elevators for both occupant egress and fire fighters access. Therefore a Workshop on the Use of Elevators in Fires and Other Emergencies was held March 2-4, 2004, in Atlanta, Georgia. The workshop was cosponsored by American Society of Mechanical Engineers (ASME International), National Institute of Standards and Technology (NIST), International Code Council (ICC), National Fire Protection Association (NFPA), U.S. Access Board, and the International Association of Fire Fighters (IAFF).

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- Develop a prioritized list of issues.
- Conduct a hazard analysis of the prioritized list of issues to see if there are any residual hazards.
- Draft code revisions for those issues that survive the process and the task group members still want addressed.

The membership of these task groups is broad and includes representatives from the elevator industry and manufacturers of devices such as fire alarms, the fire service, model codes and standards development organizations, and the accessibility community as well as fire protection engineers, architects and specialists in human factors and behavior. Since February 2005 the groups have each been conducting a hazard analysis on their assigned topic. The results of the hazard analysis focused upon the fire fighter needs is nearing completion.

The task group studied 16 different cases. In these cases a particular hazard followed by a cause/trigger was reviewed. The result of the hazard interacting with cause/trigger events may create a particular incident/effect. To address possible incident/effects corrective actions are proposed. Such corrective actions are then reviewed to see if they create any residual hazards. The hazard analysis then carries out each of the residual hazards with additional corrective actions until the hazard is mitigated. It is strictly a hazard analysis (I.e. not probabilistic) and certain assumptions were made such as a single fire start in a high rise building.

The code changes generated by this analysis are related both to the summary of corrective actions resulting from the hazard analysis and the existing language related to fire service access elevators placed into the 2007 Supplement.

These proposals will work with the 2007 Supplement requirements for fire service access elevators to address these concerns. It should be noted that the hazard analysis assumed a lobby to be directly connected with the fire service access elevator thus making the result of the analysis consistent with the philosophical approach found in the 2007 Supplement.

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: The 2007 Supplement includes a new section 3007, Fire Service Access Elevators. The requirement is scoped in Section 403.10.

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E3–07/08

1001.4 (New)

Proponent: David Frable, US General Services Administration

Add new text as follows:

1001.4 Fire safety and evacuation plans: Fire safety and evacuation plans shall be provided for all occupancies and buildings where required by the *International Fire Code*. Such fire safety and evacuation plans shall comply with the applicable provisions of Section 404 of the *International Fire Code*.

Reason: The purpose of this code change proposal is to provide consistent requirements for jurisdictions regarding requirements for fire safety and evacuation plans. We feel fire safety and evacuation plans are important issues that impact occupant egress during an emergency and therefore meets the intent of the IBC and needs to be addressed. In addition, many jurisdictions across the country currently have adopted the IBC, however many of these same jurisdictions have not adopted the IFC. This reference will ensure that at least the fire safety and evacuation plans of the IFC are adopted by reference. Enforcement of the provisions is not an issue. The provisions are clearly within the scope of the IFC.

Cost Impact: The code change proposal will not increase the cost of construction.

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E4–07/08

1001.4 (New)

Proponent: Paul K. Heilstedt, PE, Chair, representing ICC Code Technology Committee (CTC)

Add new text as follows:

1001.4 Fire safety and evacuation plans: Fire safety and evacuation plans shall be provided for all occupancies and buildings where required by the *International Fire Code*. Such fire safety and evacuation plans shall comply with the applicable provisions of the *International Fire Code*.

Reason: The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as "areas of study". Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/cc/ctc/index.html. Since its inception in April/2005, the CTC has held twelve meetings - all open to the public.

This proposed change is a follow-up to E2-07/08 which was a result of the CTC's investigation of the area of study entitled "Review of NIST WTC Recommendations". The scope of the activity is noted as:

Review the recommendations issued by NIST in its report entitled "Final Report on the Collapse of the World Trade Center Towers", issued September 2005, for applicability to the building environment as regulated by the I-Codes.

This proposal is intended to address the regulatory side of NIST recommendation 16. NIST Recommendation 16 specifically deals with public education concerning building occupants preparedness for evacuation. On the regulatory side, this is precisely what is covered in Chapter 4 of the IFC. The purpose of this code change proposal is to provide consistent requirements for jurisdictions regarding emergency planning and preparedness. Many jurisdictions across the country currently have adopted the IBC, however many of these same jurisdictions have not adopted the IFC. Hence, this proposed code change will provide consistent requirements for emergency planning and preparedness in all jurisdictions that adopt the IBC. Effectively, the IBC will adopt all of the emergency planning and preparedness provisions in the IFC.

As a follow-up to E2-07/08 it must be reinforced that this code change is indeed necessary. The committee action on E2 noted a concern over the location of the text – specifically Ch 10. While emergency planning is not a construction issue, it is clearly an issue which needs to at least be referenced in the building code in order for the designer to be aware that after the building is constructed, there are provisions in the IFC that will be applied on the day the building is occupied. Further, not all jurisdictions adopt the IFC. This reference will ensure that at least the fire safety and evacuation plans of the IFC are adopted by reference. Enforcement of the provisions is not an issue. The provisions are clearly within the scope of the IFC.

Cost Impact: The code change proposal will not increase the cost of construction.

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E14–07/08

1003.7 (IFC [B] 1003.7), 3008 (New); IFC 903.3.1.1.1 (IBC [F] 903.3.1.1.1)

Proponent: David W Frable, US General Services Administration, Gerald H Jones, representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IBC MEANS OF EGRESS AND THE IFC CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IBC MEANS OF EGRESS

1. Revise as follows:

1003.7 (IFC [B] 1003.7) Elevators, escalators and moving walks. Elevators, escalators and moving walks shall not be used as a component of a required means of egress from any other part of the building.

Exceptions:

1. Elevators used as an accessible means of egress in accordance with Section 1007.4.
2. Elevators when designed in accordance with Section 3008 for use as general egress as approved by the building official.

2. Add new text as follows:

SECTION 3008
OCCUPANT EVACUATION ELEVATORS.

3008.1 General. Elevators arranged in accordance with this section shall be permitted to be used for occupant egress in fires and other emergencies.

3008.2 Operation. The occupant evacuation elevators shall be used for occupant-controlled evacuation only in the normal elevator operating mode prior to Phase I Emergency Recall Operation in accordance with the requirements in ASME A17.1.

3008.3 New egress capacity. The total required capacity of the exit stairs on each floor can be reduced by not more than 50% where occupant evacuation elevators are provided. The amount of reduction of the required capacity of the exit stairs shall be determined by an approved egress analysis that demonstrates that the total egress time for occupants using the combination of evacuation elevators and exit stairs is not more than the total egress time for occupants only using the required exit stairs.

3008.4 Number of Occupant Evacuation Elevators. Each accessible floor that is one or more stories above or below the level of exit discharge shall be provided with a minimum of one bank or group of occupant evacuation elevators. All elevators within that bank or group of elevators, other than the fire service access elevators installed in accordance with Section 3007, shall be occupant evacuation elevators.

3008.5 Fire safety and evacuation plan. The building shall have an approved fire safety and evacuation plan in accordance with the applicable requirements of Section 404 of the International Fire Code. The subject fire safety and evacuation plan shall incorporate specific procedures for the occupants using evacuation elevators and exit stairs

3008.6 Emergency voice/alarm communication system. The building shall be provided with an emergency voice/alarm communication system. The emergency voice/alarm communication system shall be accessible to the fire department. The system shall be provided in accordance with Section 907.2.12.2.

3008.6.1 Notification appliances. A minimum of one audible and one visible notification appliance shall be installed within each occupant evacuation elevator lobby.

3008.7 Automatic sprinkler system. The building shall be protected throughout by an approved, electrically-supervised automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise permitted by Section 903.3.1.1.1.

3008.7.1 Sprinkler system monitoring. The sprinkler system shall have a sprinkler control valve and water flow device provided for each floor that is monitored by the building's emergency voice/alarm communication system.

3008.8 High hazard content areas. No building areas shall contain high hazard contents exceeding the maximum allowable quantities per control area as addressed in Section 414.2.

3008.9 Shunt breakers. Shunt breakers shall not be installed on elevator systems used for occupant evacuation elevators.

3008.10 Hoistway enclosure protection. The occupant evacuation elevators shall be located in a shaft enclosure complying with Section 707.

3008.11 Water protection. The occupant evacuation elevator hoistway and associated elevator landings shall be designed by an approved method to prevent water from infiltrating into the shaft enclosure from the operation of the automatic sprinkler system or firefighting activities.

3008.12 Occupant evacuation elevator lobby. The occupant evacuation elevators shall open into an elevator lobby in accordance with Sections 3008.12.1 through 3008.12.5.

3008.12.1 Access. The occupant evacuation elevator lobby shall have direct access to an exit enclosure.

3008.12.2 Lobby enclosure. The occupant evacuation elevator lobby shall be enclosed with a smoke barrier having a minimum 1-hour fire-resistance rating, except that lobby doorways shall comply with Section 3008.12.3.

Exception: Enclosed occupant evacuation elevator lobbies are not required at the street floor.

3008.12.2.1 Lobby construction materials. The construction materials of the lobby enclosure shall have a minimum classification level 2 rating in accordance with the requirements of ASTM C1629/C1629M.

3008.12.3 Lobby doorways. Each occupant evacuation elevator lobby shall be provided with a doorway that is protected with a 3/4-hour fire door assembly complying with Section 715.4.

3008.12.3.1 Vision panel. A vision panel shall be installed in each fire door assembly protecting the lobby doorway. The vision panel shall consist of fire protection-rated glazing and located to furnish clear vision of the occupant evacuation elevator lobby.

3008.12.3.2 Door closing. Each fire door assembly protecting the lobby doorway shall be automatic closing upon receipt of any fire alarm signal from the emergency voice/alarm communication system serving the building.

3008.12.4 Lobby size. Each occupant evacuation elevator lobby shall have minimum floor area as follows:

1. The occupant evacuation elevator lobby floor area shall accommodate, at 3 ft^2 (0.28 m^2) per person, a minimum of 25 percent of the occupant load of the floor area served by the lobby.
2. The occupant evacuation elevator lobby floor area also shall accommodate one wheelchair space of 30 in. by 48 in. (760 mm by 1220 mm) for each 50 persons, or portion thereof, of the occupant load of the floor area served by the lobby.

3008.12.5 Lobby status indicator. Each occupant evacuation elevator lobby shall be equipped with a status indicator arranged to display the following information:

1. A green light and the message, "Elevators available for occupant evacuation".
2. A yellow light and the message, "Elevators operating under fire department control to assist occupants with disabilities".
3. A red light and the message, "Elevators out of service, use exit stairs".

3008.13 Two-way communication system. Each occupant evacuation elevator car and elevator lobby shall be provided with a two-way communication system for communication between each elevator car and landing and the fire command center or a central control point location approved by the fire department. The two-way communication system shall include both audible and visible signals.

3008.13.1 Directions. Directions for the use of the two-way communication system, instructions for summoning assistance via the two-way communication system, and written identification of the location, shall be posted adjacent to the two-way communication system.

3008.14 Standpipe hose connection. A Class I standpipe hose connection in accordance with Section 905 shall be provided in the exit enclosure having direct access from the occupant evacuation elevators lobby.

3008.15 Elevator system monitoring. The occupant evacuation elevators shall be continuously monitored at the fire command center or a central control point approved by the fire department by a standard emergency service interface system meeting the requirements of NFPA 72 and arranged to display the following information:

1. Floor location of each elevator car
2. Direction of travel of each elevator car
3. Status of each elevator car with respect to whether it is occupied
4. Status of normal power to the elevator equipment, elevator controller cooling equipment, and elevator machine room ventilation and cooling equipment
5. Status of standby power to the elevator equipment, elevator controller cooling equipment, and elevator machine room ventilation and cooling equipment
6. Activation of any fire alarm initiating device in any elevator hoistway (if provided), elevator lobby, or elevator machine room
7. Occurrence of an impending over temperature condition (IOT) condition within the elevator controllers

3008.15.1 Elevator system over-ride. The fire command center or a central control point approved by the fire department shall be provided with the means to override normal elevator operation and to initiate manually a Phase I Emergency Recall of the occupant evacuation elevators in accordance with ASME A17.1.

3008.16 Electrical power. The following features serving each occupant evacuation elevators shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Elevator machine room ventilation and cooling equipment.
3. Elevator controller cooling equipment.

3008.16.1 Protection of wiring or cables. Wires or cables that provide normal and standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to fire service access elevators shall be protected by construction having a minimum 1-hour fire-resistance rating or shall be circuit integrity cable having a minimum 1-hour fire-resistance rating.

PART II – IFC

Revise as follows:

903.3.1.1.1 (IBC [F] 903.3.1.1.1) Exempt locations. Automatic sprinklers shall not be required in the following rooms or areas where such rooms or areas are protected with an approved automatic fire detection system in accordance with Section 907.2 that will respond to visible or invisible particles of combustion. Sprinklers shall not be omitted from any room merely because it is damp, of fire-resistance rated construction or contains electrical equipment.

1. Any room where the application of water, or flame and water, constitutes a serious life or fire hazard.
2. Any room or space where sprinklers are considered undesirable because of the nature of the contents, when approved by the fire code official.
3. Generator and transformer rooms separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire-resistance rating of not less than 2 hours.
4. Rooms or areas that are of noncombustible construction with wholly noncombustible contents.

5. Fire service access elevators machine rooms and machinery spaces.
6. <u>Machine rooms and machinery spaces for occupant evacuation elevators designed in accordance with Section 3008.</u>

Reason: The use of elevators for occupant egress is a significant change that will have many impacts in regulation and in building design. This proposal is intended to introduce requirements for the arrangement and design of protected elevators for occupant egress into the code without mandating them anywhere. The result would be that they can be used where approved and justified through an engineering analysis. This is no different than acceptance through a variance or performance approach as currently permitted under the code. The difference is that the requirements included in this section provide guidance on safe implementation. The inclusion of this information in the code will permit code officials and designers to develop a comfort level with the technology and to facilitate improvements to the requirements in the Code and referenced technical standards.

The current concept is being addressed by the ASME A17 Task Group on Use of Elevator for Occupant Egress the Occupant evacuation elevators that will incorporate a special evacuation protocol that will be specified in ASME A17.1. While not currently finalized, it is likely to involve the immediate evacuation of the fire floor and two floors above and below the fire floor, then awaiting a decision by the Incident Commander of whether to initiate a full building evacuation. The protocol would be terminated by the activation of Phase I recall as currently required. This protocol requires that the system recognize the floor of origin to begin the process. This would probably be initiated by the (required) sprinkler system if it is arranged to indicate sprinkler flow by floor.

For the record, GSA is committed to this endeavor and been funding research at the National Institute of Standards & Technology (NIST) for the past several years for the development of performance requirements for the use of elevators for occupant egress during a fire emergency prior to Phase I Emergency Recall. GSA has also been participating in the ASME A17 Task Groups on Use of Elevators by Firefighters and Use of Elevator for Occupant Egress regarding this subject matter.

<u>Item # 1</u>
1. RE: 1003.7 - This paragraph provides new code requirement that permits the use of elevators for general egress if approved by the building official.

<u>Item # 2</u>
(Major Issues)
1. RE: 3008 – This paragraph provides new Section of requirements that permits the use of elevators for general egress if approved by the building official.
2. RE: 3008.2 – This paragraph permits occupants to use elevators during a fire emergency prior to Phase I Emergency Recall Operation.
3. RE: 3008.3 – This paragraph permits the building official to reduce capacity of exit stairs. Experience in Asia (Taipei 101 and Petronas Towers) with egress systems that combine elevators and exit stairs has demonstrated in drills that occupant evacuation elevators can provide a safe means of egress in emergencies including fires for all occupants (including those with disabilities) and represent the only means of timely egress for occupants of very tall buildings. Where elevators are the primary means of egress in emergencies it is reasonable that the exit stair capacity can be reduced, while maintaining at least two exit stairs of adequate width and remoteness. It should be permitted to reduce stair capacity as long as the total egress time is shown by a proper egress analysis not to increase over that provided by the exit stairs alone.
4. RE: 3008.12.2 - This paragraph addresses the enclosure requirements for the lobby. A smoke barrier is the appropriate reference since it is designed to resist fire and smoke spread and is intended to create an area of refuge. The new exception addresses the need for not requiring an enclosed lobby on the street floor.
5. RE: 3008.12.2.1 – This paragraph addresses a minimum impact resistance rating for the construction materials of the lobby enclosure.
6. RE: 3008.12.4 - This paragraph addresses a minimum floor area for a lobby based on occupant load factors. Information based on current elevator lobby capacity requirements for towers in the National Fire Protection Association, Life Safety Code.
7. RE: 3008.12.5 – This paragraph addresses information that will be displayed within the occupant evacuation elevator lobby
8. RE: 3008.13 – This paragraph addresses the two-way communication system to be provided between each elevator car and landing and the fire command center or a central control point location.
9. RE: 3008.14 – This paragraph addresses requirements for a standpipe hose connection in non-required or additional exit stairways.
10. RE: 3008.15 – This paragraph addresses the minimum information to be displayed within the fire command center or a central control point location for monitoring the occupant evacuation elevators.
11. RE: 3008.15.1 - This paragraph addresses requirements for the fire command center or a central control point approved by the fire department be provided with the means to override normal elevator operation and to initiate manually a Phase I Emergency Recall of the occupant evacuation elevators in accordance with ASME A17.1.

<u>Item # 3</u>
1. RE 903.3.1.1.1 - This new exception permits automatic sprinkler protection to be exempt in occupant evacuation machine rooms and machinery spaces.

Cost Impact: The code change proposal will increase the cost of construction.
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E135–07/08

1021.3 (New), 1021.3.1(New) [IFC [B] 1021.3 (New), [B] 1021.3.1 (New)]

Proponent: Gary Lewis, Chair, representing ICC Ad Hoc Committee on Terrorism Resistant Buildings

Add new text as follows:

1021.3 (IFC [B] 1021.3) Length. In buildings with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access, exit passageways used to connect vertical exit enclosures on floors, other than the level of exit discharge, shall be not exceed 50 feet (15 240 mm) in length.

1021.3.1 (IFC [B] 1021.3.1) Signage. Exit passageways, that change direction at other than the level of exit discharge, shall be provided with exit and directional signage in accordance with Section 1011.

(Renumber subsequent sections)

Reason The purpose of this proposal is to reduce occupant confusion created by the use of horizontal transfer corridors between vertical exit enclosures.

The National Institute of Standards and Technology (NIST) World Trade Center (WTC) Report pointed out that horizontal transfers from one shaft to another caused occupant confusion and thereby slowed egress time. The WTC Report also recommended that Codes be revised to address the need for full building evacuation in the shortest possible time.

This proposal adds new Section 1021.3 to require that exit passageways, used as horizontal transfer corridors between vertical exit enclosures, be limited in length and be provided with appropriate signage. The 50 feet limit is consistent with the code's limit on dead end corridors. The code currently requires horizontal transfer in exit enclosures to comply with Section 1021; this proposal merely places a restriction on the transfer length and also requires directional signage within the exit passageway. This will reduce occupant confusion and will promote prompt evacuations. Some would argue that, although it is confusing to be required to leave a stair tower to traverse a corridor that connects to another stair tower, occupants can be trained to accept these counterintuitive horizontal transfers. However, given the impracticality of full drills in high rise buildings, this training is likely to be paper or lecture-based. At any given time, the building will have occupants who have not been trained. The proponents believe it is better to provide clear direction and limitations on the length of the transfer corridors than trying to train building occupants to follow an illogical and unclear route in a highly stressed situation. Some will argue that this provision will put constraints on design. Of course it will. All safety requirements put constraints on design. It may take a little extra effort on the part of designers, but good buildings can incorporate this type of feature if designers put safety first.

Bibliography: National Institute of Standards and Technology. Final Report of the National Construction Safety Team on the Collapses of the World Trade Center Towers. United States Government Printing Office: Washington, D.C. September 2005

Cost Impact: This proposal will not increase the cost of construction. It can be met through careful design alone.

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E145–07/08

1027.1.1, 1027.1.3, 1027.1.4, 1027.6, 1027.6.1 (New), 1027.6.2 (New) [IFC [B] 1027.1.1, [B] 1027.1.3, [B] 1027.1.4, [B] 1027.6, [B] 1027.6.1 (New), [B] 1027.6.2 (New)]

Proponent: Bob Eugene, Underwriters Laboratories Inc.

Revise as follows:

SECTION 1027 (Supp)
EXIT PATH MARKINGS

1027.1 (IFC [B] 1027.1) (Supp) General. Approved luminous markings delineating the exit path shall be provided in exit enclosures, including vertical exit enclosures and exit passageways, of buildings of Group A, B, E, I, M, and R-1 having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access and shall comply with Sections 1027.1.1 through 1027.1.7.

> **Exception:** Exit path markings shall not be required in lobbies or areas of open parking garages, where such lobby or area is located on the level of exit discharge and complies with the exception to Section 1023.1.

1027.1.1 (IFC [B] 1027.1.1) (Supp) Steps. A stripe shall be applied to the horizontal leading edge of each step and shall extend for the full length of the step. Outlining stripes shall have a minimum horizontal width of 1 inch (25 mm) and a maximum width of 2 inches (51 mm). The leading edge of the stripe shall be placed at a maximum of ½ inch (13 mm) from the leading edge of the step and the stripe shall not overlap the leading edge of the step by not more than ½ inch (13 mm) down the vertical face of the step.

Exception: The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL1994.

1027.1.2 (IFC [B] 1027.1.2) (Supp) Landings: The leading edge of landings shall be marked with a stripe consistent with the dimensional requirements for steps.

1027.1.3 (IFC [B] 1027.1.3) Handrails: All handrails and handrail extensions shall be marked with a stripe having a minimum width of 1 inch (25 mm). The stripe shall be placed on the top surface of the handrail for the entire length of the handrail, including extensions and newel post caps. Where handrails or handrail extensions bend or turn corners, the stripe shall not have a gap of more than 4 inches (102 mm).

Exception: The minimum width of 1 inch (25 mm) shall not apply to handrail stripes listed in accordance with UL1994.

1027.1.4 (IFC [B] 1027.1.4) (Supp) Perimeter demarcation lines: Stair landings and other floor areas within exit enclosures, with the exception of the sides of steps, shall be provided with demarcation lines on the floor or on the walls or a combination of both. The stripes shall be 1 (25 mm) to 2 inches (51 mm) wide with interruptions not exceeding 4 inches (102 mm).

Exception: The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL1994.

1027.1.4.1 (IFC [B] 1027.1.4.1) (Supp) Floor mounted demarcation lines: Perimeter demarcation lines shall be placed within 4 inches of the wall and shall extend to within 2 inches (51 mm) of the markings on the leading edge of landings. The demarcation lines shall continue across the floor in front of all doors.

Exception: Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

1027.1.4.2 (IFC [B] 1027.1.4.2) (Supp) Wall mounted demarcation lines: Perimeter demarcation lines shall be placed on the wall with the bottom edge of the stripe no more than 4 inches (102 mm) above the finished floor. At the top or bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches (51 mm) of the step or landing edge.

Demarcation lines on walls shall transition vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Where the wall line is broken by a door, demarcation lines on walls shall continue across the face of the door or transition to the floor and extend across the floor in front of such doors.

Exception: Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

1027.1.4.3 (IFC [B] 1027.1.4.3) (Supp) Transition. Where a wall mounted demarcation line transitions to a floor mounted demarcation line, or vice-versa, the wall mounted demarcation line shall drop vertically to the floor to meet a complimentary extension of the floor mounted demarcation line, thus forming a continuous marking.

1027.1.5 (IFC [B] 1027.1.5) (Supp) Uniformity. Placement and dimensions of markings shall be consistent and uniform throughout the same exit enclosure.

1027.1.6 (IFC [B] 1027.1.6) (Supp) Materials. Materials shall comply with Section 1027.16.1 or 1027.1.6.2

1027.1.6.1 (IFC [B] 1027.1.6.1) Self-luminous and photoluminescent. Luminescent exit path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either:

1. UL 1994, or
2. ASTM E 2072, except that the charging source shall be 1 foot candles (11 lux) of fluorescent illumination

for 60 minutes, and the minimum luminance shall be 5 milicandelas per square meter after 90 minutes.

1027.1.6.2 (IFC [B] 1027.1.6.2) Externally powered. Externally powered exit path markings shall be listed in accordance with UL 1994.

1027.1.7 (IFC [B] 1027.1.7) Illumination. Exit enclosures where photoluminescent exit path markings are installed shall be provided with the minimum means of egress illumination required by Section 1006 for at least 60 minutes prior to periods when the building is occupied.

Reason: The minimum width requirement for an outline stripe is intended to ensure that the stripe, when installed, is sufficiently visible. For a stripe Listed per UL 1994, the visibility performance is determined using the actual width of the assembled product (UL 1994 does not accommodate field-applied paints), so there is no need to subsequently specify the minimum width in the installation code. This is not the case for paints or other raw materials that could be claimed to comply with ASTM E2072, which instead relies upon a field performance test. The proposed changes allow those products that have been performance tested and are manufactured in a closely controlled environment to be utilized in accordance with listing requirements.

Additionally, externally illuminated exit path markings should also be recognized for use where the external power source is sufficient to provide 90 minutes of power and the systems conform to the performance test of the adopted standard. This performance criterion is integral to the UL 1994 Listing program.

Cost Impact: The code change proposal will not increase the cost of the construction.
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E146–07/08

403.16, 1027.1, 1027.1.1, 1027.1.3, 1027.1.4, 1027.1.6 (IFC [B] 1027.1, [B] 1027.1.1, [B] 1027.1.3, [B] 1027.1.4, [B] 1027.1.6)

Proponent: James P. Colgate, RA, Esq, City of New York, Department of Buildings

Revise as follows:

403.16 (Supp) ~~Exit~~ Luminous egress path markings. ~~Exit~~ Luminous egress path markings shall be provided in accordance with Section 1027.

SECTION 1027
~~EXIT~~ LUMINOUS EGRESS PATH MARKINGS

1027.1 (IFC [B] 1027.1) (Supp) General. Approved luminous egress path markings delineating the exit path shall be provided in exit enclosures, including vertical exit enclosures and exit passageways, of buildings of Group A, B, E, I, M, and R-1 having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access and shall comply with Sections 1027.1.1 through 1027.1.7.

Exceptions:

1. ~~Exit~~ Luminous egress path markings shall not be required on the level of exit discharge in lobbies ~~or areas of open parking garages, where such lobby or area is located on the level of exit discharge and complies with the exception to~~ that serve as part of the exit path in accordance with Section ~~1023.1~~ 1024.1, Exception 1.
2. Luminous egress path markings shall not be required in areas of open parking garages that serve as part of the exit path in accordance with Section 1024.1, Exception 3.

1027.1.1 (IFC [B] 1027.1.1) (Supp) Steps. A solid and continuous stripe shall be applied to the horizontal leading edge of each step and shall extend for the full length of the step. Outlining stripes shall have a minimum horizontal width of 1 inch (25 mm) and a maximum width of 2 inches (51 mm). The leading edge of the stripe shall be placed at a maximum of ½ inch (13 mm) from the leading edge of the step and the stripe shall not overlap the leading edge of the step by not more than ½ inch (13 mm) down the vertical face of the step.

1027.1.2 (IFC [B] 1027.1.2) (Supp) Landings: The leading edge of landings shall be marked with a stripe consistent with the dimensional requirements for steps.

1027.1.3 (IFC [B] 1027.1.3) (Supp) Handrails: All handrails and handrail extensions shall be marked with a solid and continuous stripe having a minimum width of 1 inch (25 mm). The stripe shall be placed on the top surface of the handrail for the entire length of the handrail, including extensions and newel post caps. Where handrails or handrail extensions bend or turn corners, the stripe shall not have a gap of more than 4 inches (102 mm).

1027.1.4 (IFC [B] 1027.1.4) (Supp) Perimeter demarcation lines: Stair landings and other floor areas within exit enclosures, with the exception of the sides of steps, shall be provided with solid and continuous demarcation lines on the floor or on the walls or a combination of both. The stripes shall be 1 (25 mm) to 2 inches (51 mm) wide with interruptions not exceeding 4 inches (102 mm).

1027.1.4.1 (IFC [B] 1027.1.4.1) (Supp) Floor mounted demarcation lines: Perimeter demarcation lines shall be placed within 4 inches of the wall and shall extend to within 2 inches (51 mm) of the markings on the leading edge of landings. The demarcation lines shall continue across the floor in front of all doors.

> **Exception:** Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

1027.1.4.2 (IFC [B] 1027.1.4.2) (Supp) Wall mounted demarcation lines: Perimeter demarcation lines shall be placed on the wall with the bottom edge of the stripe no more than 4 inches (102 mm) above the finished floor. At the top or bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches (51 mm) of the step or landing edge. Demarcation lines on walls shall transition vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Where the wall line is broken by a door, demarcation lines on walls shall continue across the face of the door or transition to the floor and extend across the floor in front of such doors.

> **Exception:** Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

1027.1.4.3 (IFC [B] 1027.1.4.3) (Supp) Transition. Where a wall mounted demarcation line transitions to a floor mounted demarcation line, or vice-versa, the wall mounted demarcation line shall drop vertically to the floor to meet a complimentary extension of the floor mounted demarcation line, thus forming a continuous marking.

1027.1.5 (IFC [B] 1027.1.5) (Supp) Uniformity. Placement and dimensions of markings shall be consistent and uniform throughout the same exit enclosure.

1027.1.6 (IFC [B] 1027.1.6) (Supp) Materials. ~~Luminescent exit~~ Luminous egress path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either:

1. UL 1994, or
2. ASTM E 2072, except that the charging source shall be 1 foot candle (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 5 milicandelas per square meter after 90 minutes.

1027.1.7 (IFC [B] 1027.1.7) (Supp) Illumination. Exit enclosures where photoluminescent exit path markings are installed shall be provided with the minimum means of egress illumination required by Section 1006 for at least 60 minutes prior to periods when the building is occupied.

Reason: Sections 403.16 and 1027 were added by two-thirds majority of the membership present at the ICC Final Action Hearing in Rochester. The purpose of this code change proposal is two-fold. The first is to correct terminology used throughout the aforementioned sections. Second, the proposal will clarify the graphic requirements for the proper execution of egress path marking. The change the exception to Section 1027.1 is to correctly reference the section for lobbies and parking garages that serve as part of the exit discharge.

First, this proposal will correct the terminology used in these sections to conform to the terminology used in the referenced standard UL 1994. This standard uses the term "luminous egress path markings". Therefore, the term "luminescent" will be replaced with "luminous", and the term "exit path" will be replaced with "egress path". By aligning terminology with definitions utilized by the nationally recognized referenced standard UL 1994, practitioners and interpreters of the code will be able to mitigate confusion caused by potentially conflicting terms.

Second, this proposal will clarify that the luminous stripes shall be "solid and continuous", rather than a series of dots, icons or chevrons. A consistent standard for the graphic representation of egress markings will enhance the utility of such markings and enable the safe egress of buildings.

First, the code change proposal to correct terminology can only facilitate the use of the myriad codes, standards, and local laws that govern the construction and use of buildings. All too often, identical terms are used by different codes and standards, but those terms may be defined very differently. Where possible, definitions ought to be replicated across the codes and national standards, and specific terms should be duplicated in both definition and context in order to establish regulations that are irrefutable in light of competing standards and rules.

Second, the code change proposal to clarify the graphic standard for egress path markings is necessary to maintain a universal 'language' irrespective of location. Much like the red octagon denoting a vehicular traffic 'stop,' a readily recognized graphic consistency can significantly enhance the occupants' understanding of a building and its circulation, especially in unfamiliar environments. This proposed code clarification brings the graphic requirements into conformance with New York City's low-location egress path marking requirements instituted in response to the attacks on the World Trade Center of September 11, 2001. New York City had comprehensively reviewed and tested several types of luminous egress path marking systems and found the "solid and continuous" stripes to be the most effective and have required such markings retroactively for all high rise business buildings. The proposal approved at the Final Action Hearing in Rochester in 2007 added Sections 403.16 and 1027.1 with the intent to introduce to the IBC the same requirements that are already found in the New York City. This proposal is an essential clarification to prevent non-solid and non-continuous marking stripes of the type that New York City already prohibits.

Bibliography:

1. City of New York, Department of Buildings. Building Code Reference Standard RS 6-1 and 6-1A (available at http://www.nyc.gov/html/dob/downloads/pdf/rs_6-1.pdf). Promulgated May 31, 2005.

2. City of New York, Department of Buildings. Word Trade Center Building Code Task Force: Findings and Recommendations (available at http://home2.nyc.gov/html/dob/downloads/pdf/wtcbctf.pdf). February, 2003.
City of New York.

3. Local Law 26 of 2004, Section 15, modifying Building Code Section 27-283 (available at http://www.nyc.gov/html/dob/downloads/bldgs_code/locallaw26of04.pdf). Enacted May 24, 2004.

4. UL 1994-04, Luminous Egress Path Marking Systems, with revisions through February, 2005.

Cost Impact: The code change proposal will not increase the cost of construction.

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E147–07/08

1027.1, 1027.1.6, 1027.2 (New), 1027.2.5 (New), 1027.2.6 (New), 1027.2.6.1 (New), 1027.2.6.2 (New), 1027.2.6.3 (New), 1027.3 (New), 1027.3.1 (New), 1027.7 (New), Chapter 35, (IFC [B] 1027.1, [B] 1027.1.6, [B] 1027.2 (New), [B] 1027.2.5 (New), [B] 1027.2.6 (New), [B] 1027.2.6.1 (New), [B] 1027.2.6.2 (New), [B] 1027.2.6.3 (New), [B] 1027.3 (New), [B] 1027.3.1 (New), [B] 1027.7 (New), Chapter 45)

Proponent: James P. Colgate, RA, Esq, City of New York, Department of Buildings; Thomas Jensen, City of New York Fire Department

1. Revise as follows:

SECTION 1027 (IFC [B] 1027) (Supp)
EXIT PATH MARKINGS

1027.1 (IFC [B] 1027.1) (Supp) General. Approved luminous markings delineating the exit path shall be provided in ~~exit enclosures, including vertical exit enclosures and exit passageways, of~~ buildings of Group A, B, E, I, M, and R-1 having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access ~~and shall comply with Sections 1027.1.1 through 1027.1.7~~ in accordance with Sections 1027.2 through 1027.7.

> **Exception:** Exit path markings shall not be required in lobbies or areas of open parking garages, where such lobby or area is located on the level of exit discharge and complies with ~~the exception~~ to Section ~~1023.1~~ 1024.1 Exceptions 1 or 3.

1027.2 (IFC [B] 1027.2) Markings within exit enclosures. Egress path markings shall be provided in exit enclosures, including vertical exit enclosures and exit passageways, in accordance with Sections 1027.2.1 through 1027.2.6.

~~**1027.1.1 (IFC [B] 1027.1.1)**~~ **1027.2.1 (IFC [B] 1027.2.1) (Supp) Steps.** A stripe shall be applied to the horizontal leading edge of each step and shall extend for the full length of the step. Outlining stripes shall have a minimum horizontal width of 1 inch (25 mm) and a maximum width of 2 inches (51 mm). The leading edge of the stripe shall be placed at a maximum of ½ inch (13 mm) from the leading edge of the step and the stripe shall not overlap the leading edge of the step by not more than ½ inch (13 mm) down the vertical face of the step.

~~**1027.1.2 (IFC [B] 1027.1.2)**~~ **1027.2.2(IFC [B] 1027.2.2)** **(Supp) Landings:** The leading edge of landings shall be marked with a stripe consistent with the dimensional requirements for steps.

~~**1027.1.3 (IFC [B] 1027.1.3)**~~ **1027.2.3 (IFC [B] 1027.2.3)** **(Supp) Handrails:** All handrails and handrail extensions shall be marked with a stripe having a minimum width of 1 inch (25 mm). The stripe shall be placed on the top surface of the handrail for the entire length of the handrail, including extensions and newel post caps. Where handrails or handrail extensions bend or turn corners, the stripe shall not have a gap of more than 4 inches (102 mm).

~~**1027.1.4 (IFC [B] 1027.1.4)**~~ **1027.2.4 (IFC [B] 1027.2.4)** **(Supp) Perimeter demarcation lines:** Stair landings and other floor areas within exit enclosures, with the exception of the sides of steps, shall be provided with demarcation lines on the floor or on the walls or a combination of both. The stripes shall be 1 (25 mm) to 2 inches (51 mm) wide with interruptions not exceeding 4 inches (102 mm).

~~**1027.1.4.1(IFC [B] 1027.1.4.1)**~~ **1027.2.4.1** **(IFC [B] 1027.2.4.1)** **(Supp) Floor mounted demarcation lines:** Perimeter demarcation lines shall be placed within 4 inches of the wall and shall extend to within 2 inches (51 mm) of the markings on the leading edge of landings. The demarcation lines shall continue across the floor in front of all doors.

> **Exception:** Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

~~**1027.1.4.2 (IFC [B] 1027.1.4.2)**~~ **1027.2.4.2** **(IFC [B] 1027.2.4.2)** **(Supp) Wall mounted demarcation lines:** Perimeter demarcation lines shall be placed on the wall with the bottom edge of the stripe no more than 4 inches (102 mm) above the finished floor. At the top or bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches (51 mm) of the step or landing edge. Demarcation lines on walls shall transition vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Where the wall line is broken by a door, demarcation lines on walls shall continue across the face of the door or transition to the floor and extend across the floor in front of such doors.

> **Exception:** Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

~~**1027.1.4.3 (IFC [B] 1027.1.4.3)**~~ **1027.2.4.3** **(IFC [B] 1027.2.4.3)** **(Supp) Transition.** Where a wall mounted demarcation line transitions to a floor mounted demarcation line, or vice-versa, the wall mounted demarcation line shall drop vertically to the floor to meet a complimentary extension of the floor mounted demarcation line, thus forming a continuous marking.

1027.2.5 (IFC [B] 1027.2.5) Obstacles. Obstacles at or below 6'-6" (1981 mm) in height and projecting more than 4" (102 mm) into the egress path shall be outlined with markings no less than 1" (25 mm) in width comprised of a pattern of alternating equal bands, of luminescent luminous material and black, with the alternating bands no more than 2" thick and angled at 45 degrees. Obstacles shall include, but are not limited to, standpipes, hose cabinets, wall projections, and restricted height areas. However, such markings shall not conceal any required information or indicators including but not limited to instructions to occupants for the use of standpipes.

1027.2.6 (IFC [B] 1027.2.6) Intervening doors within exit enclosures and discharge doors from exit enclosures. Doors through which occupants within an exit enclosure must pass in order to complete the exit path shall be provided with markings complying with Sections 1027.6.1 through 1027.2.6.3.

1027.2.6.1 (IFC [B] 1027.2.6.1) Low-location luminous marking for doors. The doors shall be identified by a low-location luminous marking complying with Section 1027.3.

1027.2.6.2 (IFC [B] 1027.2.6.2) Door Hardware markings. Door hardware shall be marked with no less than 16 in^2 (406 mm2) of luminous material. This marking shall be located behind, immediately adjacent to, or on the door handle and/or escutcheon. Where a panic bar is installed, such material shall be no less than 1" (25 mm) wide for the entire length of the actuating bar or touchpad.

1027.2.6.3 (IFC [B] 1027.2.6.3) Door frame markings. The top and sides of the door frame shall be marked with a solid and continuous 1" to 2" (25 mm to 51 mm) wide stripe. Where the door molding does not provide sufficient flat surface on which to locate the stripe, the stripe shall be permitted to be located on the wall surrounding the frame.

1027.3 (IFC [B] 1027.3) Markings where exit signs are provided. Where exit signs are provided in accordance with Section 1011 in interior corridors, at doors opening into exits, or within exit enclosures, approved low-location luminous egress path markings shall be provided. The top of the marking shall be not more than 18 inches (457 mm) above the finished floor. For doors, the marking shall be mounted on the door, or on the wall adjacent to latch side of the door with the nearest edge of the marking within 4 inches (100 mm) of the door frame.

1027.3.1 (IFC [B] 1027.3.1) Graphics. The marking shall comply with the following:

1. The marking shall contain the "emergency exit" symbol complying with the 1st line of Table 4.2 of NFPA 170, except that the color of the luminous portions shall be permitted to be a light, contrasting color in lieu of white. The exit symbol shall be least 4" (102 mm) high.
2. The marking shall contain the word EXIT printed in sans serif letters at least 4" (102 mm) high with strokes no less than ½" (13 mm). The color of the letters shall be the same as the exit symbol if the background is luminous, or shall be a light color or white if the letters are luminous and the background is the same color as the exit symbol.
3. In the case of markings that identify doors, the marking shall not be required to contain an arrow when mounted on the door, but shall contain an arrow when mounted on a wall. Any such arrow shall be at 45 degrees and at least 2 ¾" (70 mm) high and shall comply with the 3rd, 4th, 8th or 9th line of Table 4.2 of NFPA 170, except that the color of the arrow shall be the same as the exit symbol if the background is luminous, or shall be a light color or white if the exit symbol is luminous and the background is the same color as the exit symbol.
4. In the case of markings that do not identify a door, the sign shall contain an arrow at least 2 ¾" (70 mm) high, complying with the 2nd, 3rd, 4th, 7th, 8th or 9th line of Table 4.2 of NFPA 170, except that the color of the arrow shall be the same as the exit symbol if the background is luminescent, or shall be a light color or white if the arrow is luminescent and the background is the same color as the exit symbol.
5. Additional descriptive text shall be permitted, provided such words are in sans serif letters and are no more than one-half as high as the word EXIT or the emergency exit symbol.

~~1027.1.5 (IFC [B] 1027.1.5)~~ 1027.4 (IFC [B] 1027.4) (Supp) Uniformity. Placement and dimensions of markings shall be consistent and uniform throughout the same exit enclosure.

~~1027.1.6 (IFC [B] 1027.1.6)~~ 1027.5 (IFC [B] 1027.5) (Supp) Materials. Luminescent exit path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either:

1. UL 1994, or
2. ASTM E 2072, except that the charging source shall be 1 foot candles (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 30 milicandelas per square meter at 10 minutes and 5 milicandelas per square meter after 90 minutes.

~~1027.1.7 (IFC [B] 1027.1.7)~~ 1027.6 (IFC [B] 1027.6) (Supp) Illumination. Exit enclosures where photoluminescent exit path markings are installed shall be provided with the minimum means of egress illumination required by Section 1006 for at least 60 minutes prior to periods when the building is occupied.

1027.7 (IFC [B] 1027.7) Labeled. The markings shall be labeled in at least 6 point font with the manufacturer's name and product number, the test standard utilized, and, where ASTM E 2072 is utilized, the luminance measurements at 10 and 90 minutes.

> **Exception:** For paints and epoxies applied in the field, the labeling information shall be provided on the container.

2. Add standard to Chapter 35 (IFC Chapter 45) as follows:

NFPA

170-06 Standard for Fire Safety and Emergency Symbols

Reason: The purpose of this code change proposal is modify section 1027 to include the egress path marking components that are already required in high rise buildings in New York City.

At the Codes Forum in Orlando in 2006, the Means of Egress Committee was supportive of low-location egress path marking system for high rise buildings, but was frustrated by the number different proposals. The Committee rejected all of the proposals and suggested that the various proponents work together to resolve their differences, and to submit a more unified proposal in the future. As a result, at the Final Action hearing in Rochester, Section 1027 was added by over two-thirds majority of the membership present.

The luminous low-location egress path marking systems, required only in particular occupancies of high-rise buildings, identify the egress path elements in the event of failure of power and back-up power. Although based on the requirements already enacted in New York City, Section 1027, as adopted in Rochester, lacks some important components required in New York City and, therefore, did not result in a complete egress path marking system. Specifically, Section 1027 currently does not require the egress path marking system to include marking of obstacles, of intervening egress doors, and of access to the exit doors. This proposal will strengthen Section 1027 by adding into it these omitted features.

Organizationally, the proposal will break the egress path marking requirements into two parts. The first part will comprise Section 1027.2, and will include those markings within the exit enclosure. The second part will comprise Section 1027.3, and will include a limited amount of markings within the exit access.

This proposal will add three new components into section 1027:

1. Obstacles within exits: The current Section 1027 does not require the marking of obstacles, such as hose cabinets, radiators, pipes, etc. In dark conditions where only outlines of the steps, floors, and handrails are luminous, it is critical to mark the projecting obstacles to prevent accidents. Section 1027.2.5 will require markings of obstacles with luminous stripes.
2. Intervening doors within exits: The current Section 1027 does not require the marking of intervening doors through which an occupant who is already within the exit enclosure must thereafter pass through in order to complete the egress path. In dark conditions, it is critical to make clear to the occupant what is the next step when the stair ends abruptly at ground floor or at a transfer level. Section 1027.2.6 will require markings of such doors with luminous stripes around the door moldings, markings at the door hardware, and a low-location sign.
3. At locations where exit signs are required: The current section 1027 provides markings within the exit enclosure, but does not require any markings that identify the exits from the exit access side. When the power and back-up power fail, finding the exit in the dark would be difficult without low-location luminous markings. Section 1027.3 will require low-location markings at the door opening onto the exit and interior corridors at the same locations where high-location exit signs are required by Section 1011.

Additionally, the proposal will add a requirement for a minimum luminance measurement at 10 minutes for products tested under the ASTM

2072 testing standard. This was inadvertently omitted from the prior proposal. The 10-minute standard will ensure that the luminance has a sufficient luminance decay curve such that the markings will be brighter at the beginning of an evacuation.

Lastly, the proposal will require that the products be labeled by the manufacturer to increase accountability and prevent counterfeiting.

The new additions to Section 1027 come from the standards established by New York City's RS 6-1. The RS 6-1 was developed by the New York City Department of Buildings' architects and engineers after over one year of research of all available relevant standards, including but not limited to those published by the ASTM, UL, ISO, IMO, APTA (American Public Transportation Association). In addition, the department performed outreach and consultation with the various industries, including those from overseas. The Buildings Department also inspected mock-up/test installations of luminescent markings in various permutations, with different placement and dimensional configurations, to ensure that the resulting standards were adequate and appropriate. The result of all this research was a draft standard that was published for public comment – the public hearing on the proposal drew over 80 attendees representing a wide range of egress and safety experts. As a result of the public comment, the draft standard was refined and published in final form on May 31, 2005. Since then over 1500 installations have been completed in high rise buildings pursuant to this standard. It is on the basis of this experience that this proposal is being made.

Regarding obstacles markings, the text comes from New York City's RS 6-1. The only change to New York's city language was a clarification that required standpipe instructions should not be covered by the markings.

Regarding the intervening door markings, the text also comes from New York City's RS 6-1.

Regrading the markings on the exit access side of exit doors, the text comes from New York City's RS 6-1. However, at the time of RS 6-1's enactment in 2005, the NFPA 170 had not yet by then been updated to include the international arrow and egress symbols. As a result, RS 6-1 referenced ISO 7010 (2003). With the recent modification to NFPA 170 (2006), this proposal will reference to NFPA instead of ISO.

Regarding the 10-minute measurement at 30 milicandelas per square meter, this is the same luminance reading as specified in New York City's RS 6-1.

Regarding the labeling requirement, this is the same as specified in New York City's RS 6-1. There is no need to specify labeling for products tested to UL 1994 since UL 1994 already has a labeling provision as a condition of the listing.

Bibliography:

1. ASTM E 2072-04, Standard Specification for Photoluminescent (Phosphorescent) Safety Marking

2. City of New York, Department of Buildings. Building Code Reference Standard RS 6-1 and 6-1A (available at http://www.nyc.gov/html/dob/downloads/pdf/rs_6-1.pdf). Promulgated May 31, 2005.

3. City of New York, Department of Buildings. Word Trade Center Building Code Task Force: Findings and Recommendations (available at http://home2.nyc.gov/html/dob/downloads/pdf/wtcbctf.pdf). February, 2003.
City of New York.

4. Local Law 26 of 2004, Section 15, modifying Building Code Section 27-283 (available at http://www.nyc.gov/html/dob/downloads/bldgs_code/locallaw26of04.pdf). Enacted May 24, 2004.

5. UL 1994-04, Luminous Egress Path Marking Systems, with revisions through February, 2005.

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, NFPA 170-06, for compliance with ICC criteria for referenced standards given in Section 3.6. of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.
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E148–07/08

1027.1.6 (IFC [B] 1027.1.6)

Proponent: Manny Muniz, Manny Muniz Associates, LLC, representing himself

1. Add new text as follows:

<u>**1027.1.6 (IFC [B] 1027.1.6) Stairway floor number signs.** Stairway floor number signs required by 1020.1.6 shall also comply with Section 1027.1.8.</u>

2. Revise text as follows:

~~**1027.1.6 (IFC [B] 1027.1.6)**~~ <u>**1027.1.7 (IFC [B] 1027.1.7)**</u> **(Supp) Materials.** Luminescent exit path markings shall be permitted to be made of material including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not be limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either:

1. UL 1994 or
2. ASTM E 2072, except that the charging source shall be 1 foot candle (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 5 millicandles per square meter after 90 minutes.

~~**1027.1.7 (IFC [B] 1027.1.7)**~~ <u>**1027.1.8 (IFC [B] 1027.1.8)**</u> **(Supp) Illumination.** Exit enclosures where photoluminescent exit path markings are installed shall be provided with the minimum means of egress illumination required by Section 1006 for at least 60 minutes prior to periods when the building is occupied.

Reason: The ICC membership agreed with the New York City Building Code by voting to require that stairs, handrails and stair landings in high rise stair enclosures be marked so they are visible during normal, emergency and total blackout lighting conditions. Stairway floor numbers signs required by Section 1020.1.6 give critical egress information which should also be visible during all three of these lighting conditions.

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: The 2007 Supplement includes a new Section 1027 Exit Path Markings where this proposal language would be located. A consideration would be if this new requirement should be located in Section 1020.1.6.
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E149–07/08

1027 (IFC [B] 1027)

Proponent: Lawrence G. Perry, AIA, representing Building Owners and Managers Association (BOMA) International

Delete without substitution:

~~**SECTION 1027 (Supp)**~~
~~**EXIT PATH MARKINGS**~~

~~**1027.1 (IFC [B] 1027.1) (Supp) General.** Approved luminous markings delineating the exit path shall be provided in exit enclosures, including vertical exit enclosures and exit passageways, of buildings of Group A, B, E, I, M, and R-1 having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access and shall comply with Sections 1027.1.1 through 1027.1.7.~~

~~**Exception:** Exit path markings shall not be required in lobbies or areas of open parking garages, where such~~

lobby or area is located on the level of exit discharge and complies with the exception to Section 1023.1.

1027.1.1 (IFC [B] 1027.1.1) (Supp) Steps. A stripe shall be applied to the horizontal leading edge of each step and shall extend for the full length of the step. Outlining stripes shall have a minimum horizontal width of 1 inch (25 mm) and a maximum width of 2 inches (51 mm). The leading edge of the stripe shall be placed at a maximum of ½ inch (13 mm) from the leading edge of the step and the stripe shall not overlap the leading edge of the step by not more than ½ inch (13 mm) down the vertical face of the step.

1027.1.2 (IFC [B] 1027.1.2) (Supp) Landings: The leading edge of landings shall be marked with a stripe consistent with the dimensional requirements for steps.

1027.1.3 (IFC [B] 1027.1.3) (Supp) Handrails: All handrails and handrail extensions shall be marked with a stripe having a minimum width of 1 inch (25 mm). The stripe shall be placed on the top surface of the handrail for the entire length of the handrail, including extensions and newel post caps. Where handrails or handrail extensions bend or turn corners, the stripe shall not have a gap of more than 4 inches (102 mm).

1027.1.4 (IFC [B] 1027.1.4) (Supp) Perimeter demarcation lines: Stair landings and other floor areas within exit enclosures, with the exception of the sides of steps, shall be provided with demarcation lines on the floor or on the walls or a combination of both. The stripes shall be 1 (25 mm) to 2 inches (51 mm) wide with interruptions not exceeding 4 inches (102 mm).

1027.1.4.1 (IFC [B] 1027.1.4.1) (Supp) Floor mounted demarcation lines: Perimeter demarcation lines shall be placed within 4 inches of the wall and shall extend to within 2 inches (51 mm) of the markings on the leading edge of landings. The demarcation lines shall continue across the floor in front of all doors.

Exception: Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

1027.1.4.2 (IFC [B] 1027.1.4.2) (Supp) Wall mounted demarcation lines: Perimeter demarcation lines shall be placed on the wall with the bottom edge of the stripe no more than 4 inches (102 mm) above the finished floor. At the top or bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches (51 mm) of the step or landing edge. Demarcation lines on walls shall transition vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Where the wall line is broken by a door, demarcation lines on walls shall continue across the face of the door or transition to the floor and extend across the floor in front of such doors.

Exception: Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

1027.1.4.3 (IFC [B] 1027.1.4.3) (Supp) Transition. Where a wall mounted demarcation line transitions to a floor mounted demarcation line, or vice-versa, the wall mounted demarcation line shall drop vertically to the floor to meet a complimentary extension of the floor mounted demarcation line, thus forming a continuous marking.

1027.1.5 (IFC [B] 1027.1.5) (Supp) Uniformity. Placement and dimensions of markings shall be consistent and uniform throughout the same exit enclosure.

1027.1.6 (IFC [B] 1027.1.6) (Supp) Materials. Luminescent exit path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either:

1. UL 1994, or
2. ASTM E 2072, except that the charging source shall be 1 foot candle (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 5 milicandelas per square meter after 90 minutes.

1027.1.7 (IFC [B] 1027.1.7) (Supp) Illumination. Exit enclosures where photoluminescent exit path markings are installed shall be provided with the minimum means of egress illumination required by Section 1006 for at least 60

~~minutes prior to periods when the building is occupied.~~

Reason: This proposal seeks to eliminate the requirement for photoluminescent exit path markings in exit enclosures and exit passageways in new high-rise buildings. These provisions were added to the IBC via a successful public comment to Code Change E84-06/07.
In New York City, which has been using similar provisions for several years, building owners and managers have been experiencing problems with installed materials coming loose, wearing away, or otherwise being adversely affected, due to everyday use and/or housekeeping operations.

Additionally, it is not clear if these new products will continue to meet their required performance criteria after being in place for any length of time. There is not yet any criteria available to determine on what frequency the photoluminescent materials should be inspected, re-tested, or replaced.

BOMA remains concerned that the provisions, as approved, have significant technical problems.

- The provisions allow a mixing-and-matching of demarcation lines on floors and on walls, without adequate provisions to ensure that the installation will provide a clear definition of the egress path and wall/floor intersection.
- The provisions allow wall markings up to 4" above the floor, which may confuse by making it appear that the landing floor level is 4" higher than it actually is, thereby creating a tripping hazard.
- The provisions allow the mixing-and-matching of materials from the two referenced standards (UL 1994 and ASTM E 2072). These standards have significantly different performance criteria, which may lead to a significant variation in levels of performance.
- Recent research done in Canada appears to indicate that not marking the center of landings my cause occupants to hesitate as they reach the landing, potentially creating a negative impact of egress speed.

Cost Impact: The code change proposal will not increase the cost of construction.