CTC AREA OF STUDY – NIST WTC RECOMMENDATIONS

2006/2007 CODE CHANGES SUBMITTED BY OTHER THAN CTC, TRB OR NIBS/MMC

The following code changes have been identified as code changes submitted by other than the ICC Code Technology Committee (CTC), ICC Ad Hoc Committee on Terrorism Resistant Buildings (TRB) and the NIBS/MMC Committee for Translating the NIST WTC Investigation Recommendations in the Building Codes (NIBS/MMC) related to the NIST WTC Report. Under a separate document, the code changes submitted by the CTC, TRB and the NIBS/MMC have been compiled.

The code changes are organized based on the published code changes as follows:

S17–06/07
1609.1.1, 1609.1.1.2 through 1609.1.1.2.2 (New)

Proponent: T. Eric Stafford, Institute for Business and Home Safety

1. Revise as follows:

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapter 6 of ASCE 7. The type of opening protection required, the basic wind speed and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7.Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of SBCCI SSTD 10 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of the AF&PA WFCM.
3. Designs using NAAMM FP 1001.
4. Designs using TIA/EIA-222 for antenna-supporting structures and antennas.
5. Wind Tunnel tests in accordance with Section 6.6 of ASCE 7, subject to the limitations in Section 1609.1.1.2.

2. Add new text as follows:

1609.1.1.2 Wind tunnel test limitations. The lower limit on pressures for main wind-force resisting systems and components and cladding shall be in accordance with Sections 1609.1.1.2.1 and 1609.1.1.2.2.

1609.1.1.2.1 Lower limits on main wind-force-resisting system. Pressures determined from wind tunnel testing shall be limited to not less than 80 percent of the design pressures determined in accordance with Section 6.5 of ASCE 7, unless specific testing is performed that demonstrates it is the aerodynamic coefficient of the building, rather than shielding from other structures, that is responsible for the lower values. The 80 percent limit may be adjusted by the ratio of the frame load at critical wind directions as determined from wind tunnel testing without specific adjacent buildings, but including appropriate upwind roughness, to that determined in Section 6.5 of ASCE 7.

1609.1.1.2.2 Lower limits on components and cladding. The design pressures for components and cladding on walls or roofs shall be selected as the greater of the wind tunnel test results or 80 percent or the pressure obtained for Zone 4 for walls and Zone 1 for roofs as determined in Section 6.5 of ASCE 7, unless specific testing is performed that demonstrates it is the aerodynamic coefficient of the building, rather than shielding from nearby structures, that is responsible for the lower values. Alternatively, limited tests at a few wind directions without specific adjacent buildings, but in the presence of an appropriate upwind roughness, shall be permitted to be used to demonstrate that the lower pressures are due to the shape of the building and not to shielding.

Reason: This code change brings forward recommendations currently in the ASCE 7-05 commentary and gives the limitations the force of code provisions. Recent comparisons between wind tunnel studies for the same building have demonstrated a difference of up to 40% in results between laboratories. These provisions will provide a limit on reductions that will provide a baseline threshold value. This is being proposed in the IBC at this time because it is our understanding that ASCE 7 will not be revised again until 2010.

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

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

FS168–06/07
915 (New)

Proponent: Robert J Davidson, Davidson Code Concepts, Tinton Falls, NJ, representing himself

Add new text as follows:

SECTION 915
EMERGENCY RESPONDER SAFETY FEATURES

915.1 Shaftway markings. Vertical shafts shall be identified as required by this section.

915.1.1 Exterior access to shaftways. Outside openings accessible to the fire department and which open directly on a hoistway or shaftway communicating between two or more floors in a building shall be plainly marked with the word SHAFTWAY in red letters at least 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible from the outside of the building.

915.1.2 Interior access to shaftways. Door or window openings to a hoistway or shaftway from the interior of the building shall be plainly marked with the word SHAFTWAY in red letters at least 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible.

> **Exception**: Marking shall not be required on shaftway openings which are readily discernible as openings onto a shaftway by the construction or arrangement.

915.2 Pitfalls. The intentional design or alteration of buildings to disable, injure, maim or kill intruders is prohibited. No person shall install and use firearms, sharp or pointed objects, razor wire, explosives, flammable or combustible liquid containers, or dispensers containing highly toxic, toxic, irritant or other hazardous materials in a manner which may passively or actively disable, injure, maim or kill an emergency responder who forcibly enters a building for the purpose of controlling or extinguishing a fire, rescuing trapped occupants or rendering other emergency assistance

915.3 Equipment room identification. Fire protection equipment shall be identified in an approved manner. Rooms containing controls for air-conditioning systems, sprinkler risers and valves, or other fire detection, suppression or control elements shall be identified for the use of the fire department. Approved signs required to identify fire protection equipment and equipment location, shall be constructed of durable materials, permanently installed and readily visible.

Reason: This proposal provides correlation between the International Building Code and the International Fire Code by copying existing language from the IFC into the IBC.

The IBC's stated intent in Section 101.3 includes the safety of emergency responders when operating in buildings and structures. Recognizing the multitude of different ways that the IBC, the IFC, or both are adopted and enforced, these codes must work either together or separately to accomplish the desired result. There are a number of construction (brick & mortar) provisions related to emergency responder safety which appear in the IFC but not the IBC. This potentially results in a gap in certain scenarios, especially jurisdictions which adopt the IBC but not the IFC, or where the IFC is enforced by a fire code official outside the building permitting and inspection process.

The labeling of shaft hazards, prohibition of pitfalls and the marking of equipment doors for identification of controls are important at all times and should be addressed by the IBC at the time of construction in addition to be identified and maintained during maintenance inspections under the IFC.

Certainly it is not the intent to build a structure without critical safety features necessary for Emergency responder activities that routinely occur before a maintenance inspection is scheduled at newly constructed buildings and structures.

Recognizing the multitude of different ways that the IBC, the IFC, or both are adopted and enforced, these codes must work either together or separately to accomplish the desired result.

This effort was initiated by an action item from ICC's Federal Agency Codes and Standards Forum. There is a need for this in jurisdictions without the IFC, and this change will streamline the design process in jurisdictions where both codes were in effect.

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

Analysis: The maintenance of the technical contents of IFC Sections 507.2, 507.3 and 510.1 (source of this proposal) rests with the IFC Code Development Committee. The need for and suitability of duplicating the text of these sections into the IBC is a matter to be determined by the IBC-Fire Safety Code Development Committee. Note that this proposed code change does not include any technical modifications to the content of IFC Sections 507.2, 507.3 and 510.1.

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

G58–06/07
403.3.1

Proponent: George Thomas, P.E., CBO, City of Pleasanton, representing the Tri-Chapters Code Committee and Laura Blaul, Orange County Fire, representing the California Fire Chiefs Association

Revise as follows:

403.3.1 Type of construction. The following reductions in the minimum construction type allowed in Table 601 shall be allowed as provided in Section 403.3:

1. For buildings not greater than 420 feet (128 m) in height, Type IA construction shall be allowed to be reduced to Type IB.

   Exception: The required fire-resistance rating of ~~columns supporting floors~~ the structural frame shall not be allowed to be reduced.

2. In other than Groups F-1, M and S-1, Type IB construction shall be allowed to be reduced to Type IIA.
3. The height and area limitations of the reduced construction type shall be allowed to be the same as for the original construction type.

Reason: It is only logical that if the fire rating for a column in a high rise building is not permitted to be reduced due to the presence of automatic sprinklers, then beams that frame into such columns should likewise retain their full fire-resistive rating. An inconsistency in this regard has occurred with the approval of code change G53-04/05, which only retains the full fire-resistance for the column portion of the structural frame. We believe that beams framing into columns in buildings required to be of Type IA construction should retain a 3-hour fire resistance, because the beams can play an equal or greater role in collapse prevention under fire conditions than would be demanded of the column portion of the structural frame.

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

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

G59–06/07
403.3.1

Proponent: Richard Schulte, Schulte & Associates

Add new text as follows:

403.3.1 Type of construction. The following reductions in the minimum construction type allowed in Table 601 shall be allowed as provided in Section 403.3:

~~1. For buildings not greater than 420 feet (128 m) in height, Type IA construction shall be allowed to be reduced to Type IB.~~

~~**Exception:** The required fire-resistance rating of columns supporting floors shall not be allowed to be reduced.~~

1. Type IA construction shall be allowed to be reduced to Type IB construction in portions of the building which are classified as light hazard as defined in NFPA 13.

~~2. In other than Groups F-1, M and S-1, Type IB construction shall be allowed to be reduced to Type IIA.~~

2. Type IB construction shall be allowed to be reduced to Type IIA construction in portions of the building which are classified as light hazard hazard as defined in NFPA 13.
3. The height and area limitations of the reduced construction type shall be allowed to be the same as for the original construction type.

Reason: The purpose of this change is to permit the required fire resistance ratings for portions of a high rise building where the average fire load does not exceed 10 pounds (wood equivalent) per square foot to be reduced by 1 hour.

The intensity of a fire which develops in portions of a building with a fire load of 10 pounds per square foot is roughly equivalent to a 1 hour exposure to the ASTM E119 time-temperature curve. Based upon this, providing Type IIA construction for office and residential portions of buildings which are 180 feet or less in height and Type IB construction for office and residential portions of buildings which are greater than 180 feet in height should provide more than adequate structural fire resistance to prevent the collapse of high rise buildings in a major fire in the event of sprinkler system failure.

NFPA 13 defines the term "light hazard" as a portion of a building where the quantity and combustibility of the contents is low and where fires with only relatively low rates of heat release occur. (NFPA 13 indicates that offices, apartment units, hotel rooms and corridors are typically classified as a light hazard occupancy.) Based upon this, it can be stated that the typical fire load in portions of a building classified as a light hazard is 10 pounds (wood equivalent) per square foot.

The National Bureau of Standards (NBS) determined that there is a correlation between fire loading (measured in pounds of wood equivalent per square foot) and fire severity (as measured by an exposure to ASTM E119) over 80 years ago. (One pound of wood is assumed to have a heat content of 8,000 Btu's. The fire load, measured in pounds of wood equivalent per square foot, is determined by dividing the heat content of the building contents (on a square foot basis) by 8,000 Btu per pound.) The NBS research determined the following correlation:

Fire Loading (Wood Equivalent)	**Fire Severity** (ASTM E119 Exposure)
5 psf	30 minutes
10 psf	1 hour
20 psf	2 hours

Later research conducted by the National Bureau of Standards determined that the fire loading of offices and residential occupancies averaged between 5 and 10 pounds (of wood equivalent) per square foot. Based upon this, the severity of a fire in a typical office or residential occupancy would be equivalent to a maximum 1 hour exposure to the ASTM E119 time-temperature curve.

Recently, the investigation into the collapse of the World Trade Center (WTC) towers conducted by NIST has confirmed the relationship between fire loading and the intensity of the fire exposure for portions of a building classified as light hazard. The NIST investigation determined that the fire loading on the floors of aircraft impact in the WTC towers was between 4 and 5 pounds per square foot (except in areas in the WTC 2 tower where combustible were pushed from one area into another area by the aircraft impact) and that the fires in any one (undisturbed) portion of the floors burned for approximately 20 minutes prior to consuming all the fuel in the area. Given that the recently published NIST research has confirmed the relationship between fire load and fire intensity for portions of buildings classified as light hazard (per NFPA 13), it seems reasonable that we can utilize the NIST research to reduce the required fire resistance ratings by 1 hour as was permitted by the BOCA Code since 1975 and as was permitted in the 2000 and 2003 editions of the International Building Code. In effect, the NIST research has served to confirm the reduction in fire resistance ratings for the structure elements of high rise office and residential buildings was valid.

Table 601 in the International Building Code indicates that the structural frame and floor construction in Type IB construction is required to develop a minimum 2 hour fire resistance rating. Given the correlation between fire loading and fire severity established by the National Bureau of Standards and the recently released NIST WTC investigation, providing Type IB construction in portions of high rise office and residential buildings which exceed 180 feet in height will provide a structural fire resistance which exceeds the maximum fire severity which can occur by one hour. Based upon this, providing Type IB construction in portions of high rise buildings classified as light hazards will provide more than adequate structural fire resistance to prevent building collapse in the event of a typical fire which can occur in these occupancies.

Similarly, providing Type IIA construction for office and residential portions of high rise buildings which are less than 180 feet in height should suffice because the fire resistance ratings will be equal to the maximum severity of a fire which can occur and buildings of this height can be evacuated rapidly.

When considering this proposal, it should be noted that the maximum fire resistance rating required for the floor construction for both Type IA and Type IB construction is 2 hours. This is the same fire resistance rating as the rating of the floor construction in the First Interstate Bank Building in Los Angeles. In May, 1988, the First Interstate Bank Building was subjected to a major fire which spread through 5 floors in the building without floor collapse. The fire in the First Interstate Bank Building is an excellent example of the capability of 2 hour fire resistive construction to provide adequate protection against collapse when exposed to a major fire which occurs in an office occupancy.

Another example of the ability of two hour construction to resist the effects of fire are the fires which occurred in the WTC towers as a result of terrorist attacks on September 11th. Despite the fact that the structural systems supporting the building suffered major damage and that much of the structural fire protection was damaged on the floors where the fires occurred, WTC 1 was able to withstand the effects of fires for approximately 102 minutes (1 hour, 42 minutes) prior to collapsing. The performance of WTC 1 clearly demonstrates that 2 hour structural fire protection is adequate in portions of high rise buildings used for offices. (The WTC 2 tower collapsed in only 56 minutes because the WTC 2 tower initially suffered more serious structural damage than the WTC 1 tower and because the aircraft impact pushed combustible from one area into another portion of the building, thereby increasing the fire loading in a portion of the tower.)

It should be noted that the above discussion assumes that the sprinkler system provided will fail and that the fire department will not attempt to extinguish the fire. Hence, sprinkler protection and manual firefighting provide additional factors of safety in preventing building collapse beyond that provided by the building construction type.

It should also be noted that approval of this code change could result in portions of the structural systems with 2 hour structural fire protection supporting portions of the structure with a 3 hour fire resistance. Although this appears to be contrary to one of the fundamental concepts of the code, this scenario does not actually violate the concept that structural supports have the same or greater fire resistance rating as the structural element being supported because the fire resistance of a 2 hour structural element exposed by a fire with a maximum severity equivalent to a 1 hour exposure to the ASTM E119 time-temperature curve is infinite in a real fire. In other words, the performance of a 2 hour structural element (determined per ASTM E119) exposed to a 1 hour fire is essentially the same as a structural element with an infinite fire resistance rating.

One final note, approval of the above proposal will result in a building with mixed construction types. This code provision could result in the lower stories of a high rise building being constructed to comply with the requirements for Type IA construction, while the upper stories of the building would be permitted to be constructed to comply with the requirements for Type IB construction.

Bibliography:

<u>Fire Protection In Modern Building Codes</u>, 4th Edition (1974), American Iron and Steel Institute (AISI).

<u>Final Report on the Collapse of the World Trade Center Towers</u>, NCSTAR 1 (pages 125 through 149), National Institute of Standards and Technology, October, 2005.

Cost Impact: The code change proposal will in general reduce construction costs.

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

G60–06/07
403.3.1

Proponent: Thomas Kinsman, T.A. Kinsman Consulting Company, Bellevue, WA

Revise as follows:

403.3.1 Type of construction. The following reductions in the ~~minimum construction type allowed~~ minimum fire resistive values of the building elements in Table 601 shall be ~~allowed as provided in Section 403.3~~ permitted as follows:

1. For buildings not greater than 420 feet (128 m) in height, the fire resistive values of the building elements in Type IA construction shall be ~~allowed~~ permitted to be reduced to the minimum fire resistive values for the building elements in Type IB.

   Exception: The required fire-resistance rating of columns supporting floors shall not be ~~allowed~~ permitted to be reduced to the fire resistive value for columns in Type IB.

2. In other than Groups F-1, M and S-1, the fire resistive values of the building elements in Type IB construction shall be ~~allowed~~ permitted to be reduced to the fire resistive elements for columns in Type IIA.
3. The height and area limitations of ~~the~~ a building containing building elements with reduced ~~construction type~~ fire resistive values shall be ~~allowed~~ permitted to be the same as ~~for the original construction type~~ the building without such reductions.

Reason: The purpose of this code change is to clarify the language and make it consistent with the charging 403.3 section title and paragraph which addresses fire resistive reductions rather than construction type reductions. It is not intended to make any substantive changes to the current code.

The construction types haven't changed as indicated by the fact that these buildings, even with the fire resistive reductions in the building elements, are still permitted to use the unreduced construction type with respect to Table 503. In addition, there is now the anomaly of buildings < 420 feet high with all elements reduced to IB, except for the columns – so in such cases, the reduced building really isn't a IB either.

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

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

G61–06/07
403.3.1

Proponent: John Berry, Cole + Russell Architects, Inc., Cincinnati, OH

Revise as follows:

403.3.1 Type of construction. The following reductions in the minimum construction type allowed in Table 601 shall be allowed as provided in Section 403.3. The height and area limitations of the reduced construction type shall be allowed to be the same as for the original construction type:

1. For buildings not greater than 420 feet (128 m) in height, Type IA construction shall be allowed to be reduced to Type IB.

   Exception: The required fire-resistance rating of columns supporting floors shall not be allowed to be reduced.

2. In other than Groups F-1, M and S-1, Type IB construction shall be allowed to be reduced to Type IIA.
3. ~~The height and area limitations of the reduced construction type shall be allowed to be the same as for the original construction type.~~

Reason: Item #3 to Section 403.3.1 as it currently is included in the IBC is not a reduction, but rather clarification as to how the reductions are to be applied. Relocating item #3 to the main paragraph clarifies the grammatical structure of the paragraph and reinforces the intent of the code.

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

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

G62–06/07
403.3.1

Proponent: Bob Boyer, Building Officials Association of Florida (BOAF) Code Development Committee, Longwood, FL

Revise as follows:

403.3.1 Type of construction. The following reductions in the minimum construction type allowed in Table 601 shall be allowed as provided in Section 403.3:

1. For buildings not greater than 420 feet (128 m) in height, Type IA construction shall be allowed to be reduced to Type IB.

   Exception: The required fire-resistance rating of ~~columns supporting floors~~ the structural frame shall not be allowed to be reduced.

2. In other than Groups F-1, M and S-1, Type IB construction shall be allowed to be reduced to Type IIA.
3. The height and area limitations of the reduced construction type shall be allowed to be the same as for the original construction type.

Reason: The approved code change G53-04/05 in last years cycle now permits the type of construction for buildings less than or equal to 420 feet in height to be reduced from Type IA to Type IB; however, columns supporting floors are not permitted to be reduced. This code change will correct the inconsistency by requiring that the columns and beams framing into the columns have equal ratings.

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

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

G64–06/07
403.15 (New), 708.1

Proponents: George Thomas, PE, CBO, Pleasanton, CA, representing the California Fire Chiefs Association and Tri-Chapter Code Committee

1. Add new text as follows:

403.15 Corridors in Group B occupancies. For buildings greater than 420 feet in height, corridors serving more than one tenant space and providing direct access to at least one exit shall be enclosed by walls constructed as 1-hour fire-resistance rated fire partitions complying with Section 708.

2. Revise as follows:

708.1 General. The following wall assemblies shall comply with this section:

1. Walls separating dwelling units in the same building.
2. Walls separating sleeping units in occupancies in Group R-1 hotel, R-2 and I-1 occupancies.
3. Walls separating tenant spaces in covered mall buildings as required by Section 402.7.2.
4. Corridor walls as required by Section 1017.1.
5. Elevator lobby separation as required by Section 707.14.1.
6. Residential aircraft hangars.
7. Corridor walls in Group B occupancies in high-rise buildings greater than 420 feet in height as required by Section 403.15.

Reason: Compartmentation of floors in Group B occupancies provides an important life safety function during a fire event. During a previous code change cycle we and other ICC Chapters submitted Public Comments on G55-03/04 which were successful in eliminating the sprinkler trade-off that would reduces the fire-resistance ratings of exit enclosures (shafts) from 3-hours to 2-hours for high rise buildings over 420 feet. This code change which will add a requirement that a corridor serving floors more than one tenant space in a Group B Occupancy in high rise buildings in excess of 420 feet shall have a 1-hour minimum fire-resistance rating. This is necessary because the fire service does not have access to apparatus capable of providing adequate water pressure or flow to floors located greater than 420 feet in height. Without the sprinkler system's ability to provide the level of reliability as is possible in high rise buildings of lesser height, we believe that compartmentation of corridors should be provided as an additional life safety measure.

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

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

G65–06/07

403.15 (New), 708.1, Table 1017.1 (IFC [B] Table 1017.1)

Proponent: Bob Boyer, Building Officials Association of Florida (BOAF) Code Development Committee

1. Add new text as follows:

403.15 Corridors in Group B occupancies. For Group B occupancies in buildings greater than 420 feet in height, corridors serving more than one tenant space and providing direct access to an exit shall be constructed as 1-hour fire-resistance rated fire partitions in accordance with Section 708.

2. Revise as follows:

708.1 General. The following wall assemblies shall comply with this section:

1. Walls separating dwelling units in the same building.
2. Walls separating sleeping units in occupancies in Group R-1 hotel, R-2 and I-1 occupancies.
3. Walls separating tenant spaces in covered mall buildings as required by Section 402.7.2.
4. Corridor walls as required by Section 1017.1.
5. Elevator lobby separation as required by Section 707.14.1.
6. Residential aircraft hangars.
7. Corridor walls in Group B occupants in high-rise buildings greater than 420 feet in height as required by Section 403.15.

TABLE 1017.1
CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system[c]
H-1, H-2, H-3	All	Not Permitted	1
H-4, H-5	Greater than 30	Not Permitted	1
A, B, E, F, M, S, U	Greater than 30	1	0[d]
R	Greater than 10	Not Permitted	0.5
I-2[a], I-4	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1[b]

a. For requirements for occupancies in Group I-2, see Section 407.3.
b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see Section 408.7.
c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.
d. Corridor walls in Group B occupancies in high-rise buildings greater than 420 feet in height shall be in accordance with Section 403.15.

Reason: Fire department apparatus is generally not capable of supplying adequate water in terms of pressure and flow to floors located above 420 feet in height. So if the water supply fails, there is no practical means for fighting a fire on those upper floors of such buildings, so the building must be able to stand on its own, and the occupants must have adequate time to safely egress such tall buildings. Super high rises must provide additional protection for the occupants of those buildings who may experience longer periods of time to evacuate or to be rescued.

Corridors should be maintained relatively smoke free because of the requirements that the doors be smoke and draft control type doors to prevent smoke from entering the corridor from a fire in an adjacent compartment. Protection of duct openings with smoke dampers is also required to minimize the spread of smoke into the means of egress route providing access to the exits. And any penetrations of the corridor walls and ceilings are required to be protected against the spread of fire and hot gases.

However, there the compounding effect of other sprinkler trade-offs that should be taken into consideration if the sprinklers fail to activate satisfactorily due to any cause. The travel distances are allowed to be increased 50% from 200 feet to 300 feet where automatic sprinkler systems are provided. The separation of exits (remoteness) is also allowed to be reduced where automatic sprinkler systems are installed. Interior finish requirements are relaxed within corridors where Class C interior finish can be used in lieu of Class B interior finish and Class B interior finish can be used where Class A interior finish would otherwise be required if not for the installation of automatic sprinklers. And dead end corridors are allowed to be increased in length by 150%, i.e. from 20 feet to 50 feet, where automatic sprinkler systems are provided. Therefore, the fortifying of corridors should effectively provide an area for both the occupants and emergency responders to rely on for protection.

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

Analysis: The action on the proposed change to Section 708.1 and Table 1017.1 is dependent on the decision of the General Committee to Section 403.15 of the proposal, therefore, for consistency, the General Committee will make the determination for this entire proposal instead of being split with the MOE and FS Committees.

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

G66–06/07
403.15 (New), 708.1

Proponents: George Thomas, PE, CBO, Pleasanton, CA, representing the California Fire Chiefs Association and Tri-Chapter Code Committee; Laura Blaul and Lorin Neyer, representing the California Fire Chief's Association

1. Add new text as follows:

403.15 Corridors in Group R occupancies. For buildings greater than 420 feet in height, the fire-resistance rating required by Table 1017.1 for corridors in Group R occupancies shall be increased to 1-hour.

2. Revise as follows:

708.1 General. The following wall assemblies shall comply with this section:

1. Walls separating dwelling units in the same building.
2. Walls separating sleeping units in occupancies in Group R-1 hotel, R-2 and I-1 occupancies.
3. Walls separating tenant spaces in covered mall buildings as required by Section 402.7.2.
4. Corridor walls as required by Section 1017.1.
5. Elevator lobby separation as required by Section 707.14.1.
6. Residential aircraft hangars.
7. Corridor walls in Group R occupancies in high-rise buildings greater than 420 feet in height as required by Section 403.15.

Reason: Compartmentation of floors in Group R occupancies provides an important life safety function during a fire event. During a previous code change cycle we and other ICC Chapters submitted Public Comments on G55-03/04 which were successful in eliminating the sprinkler trade-off that would reduces the fire-resistance ratings of exit enclosures (shafts) from 3-hours to 2-hours for high rise buildings over 420 feet. This code change which will add a requirement that a corridor serving floors more than one tenant space in a Group R Occupancy in high rise buildings in excess of 420 feet shall have a 1-hour minimum fire-resistance rating. This is necessary because the fire service does not have access to apparatus capable of providing adequate water pressure or flow to floors located greater than 420 feet in height. Without the sprinkler system's ability to provide the level of reliability as is possible in high rise buildings of lesser height, we believe that compartmentation of corridors should be provided as an additional life safety measure.

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

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

G67–06/07
403.15 (New), 708.1, Table 1017.1 (IFC [B] Table 1017.1)

Proponent: Bob Boyer, Building Officials Association of Florida (BOAF) Code Development Committee

1. Add new text as follows:

403.15 Corridors in Group R occupancies. For buildings greater than 420 feet in height, the fire-resistance rating for corridors in Group R occupancies shall be constructed of 1-hour fire partitions in accordance with Section 708.

2. Revise as follows:

708.1 General. The following wall assemblies shall comply with this section:

1. Walls separating dwelling units in the same building.
2. Walls separating sleeping units in occupancies in Group R-1 hotel, R-2 and I-1 occupancies.
3. Walls separating tenant spaces in covered mall buildings as required by Section 402.7.2.
4. Corridor walls as required by Section 1017.1.
5. Elevator lobby separation as required by Section 707.14.1.
6. Residential aircraft hangars.
7. Corridor walls in Group R occupancies in high-rise buildings greater than 420 feet in height as required by Section 403.15.

TABLE 1017.1
CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system[c]
H-1, H-2, H-3	All	Not Permitted	1
H-4, H-5	Greater than 30	Not Permitted	1
A, B, E, F, M, S, U	Greater than 30	1	0
R	Greater than 10	Not Permitted	0.5[d]
I-2[a], I-4	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1[b]

a. For requirements for occupancies in Group I-2, see Section 407.3.
b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see Section 408.7.
c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.
d. Corridor walls in Group R occupancies in high-rise buildings greater than 420 feet in height shall be in accordance with Section 403.15.

Reason: This code change proposal increases the required fire resistance rating of corridors serving Group R occupancies in greater than 420 feet in height (super high rises) from 30 minutes to 1-hour.

The people who reside in super high rise buildings should be provided with an enhanced level of fire safety for the means of egress as they wait in queue for the stairs, or for the appropriate exiting sequence, or for rescue by the responding fire department or other emergency services. A 1-hour fire resistance rated corridors also assists emergency responders.

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

Analysis: The action on the proposed change to Section 708.1 and Table 1017.1 is dependent on the decision of the General Committee to Section 403.15 of the proposal, therefore, for consistency, the General Committee will make the determination for this entire proposal instead of being split with the MOE and FS Committees.

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

G70–06/07

403.15 (New)

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

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

Add new text as follows:

403.15 Exit stairway and elevator hoistway shaft enclosure integrity. For buildings greater than 420 feet in height, exit stairways and elevator hoistways shall be enclosed with fire barriers tested in accordance with ASTM E119 with the hose stream test conducted at the end of the fire-resistance test to determine structural integrity.

Reason: This proposed code change basically establishes an enhanced structural integrity requirement for elevator shaft hoistway and exit stairway enclosures in what we call super high rise buildings, i.e. those buildings greater than 420 feet in height. The basis for the enhanced structural integrity performance is the option to conduct the hose stream test in the ASTM E119 fire resistance test at the end of the entire fire test. This method for conducting the hose stream test is based on Section 11.3 of that standard. The hose stream option under Section 11.3 specifies that the hose stream test be applied at the end of the fire resistance test. In the case of these shaft enclosures regulated by the high rise building requirements of the International Building Code (IBC), that would occur at the end of the 2 hour fire resistance test. Passing this test would indicate an enhanced structural integrity of these shaft enclosures as compared to walls tested using the standard hose stream test which is conducted after a duplicate specimen has been fire tested for one half the fire resistance rating period (not to exceed 1 hour) after which the hose stream test is then applied as specified in Section 11.2 of ASTM E119.

Final recommendations from the NIST World Trade Center fire and collapse investigation suggest that there is a need to provide minimum structural integrity for the means of egress including the stairwells and the elevator shafts that may be used for emergency access by emergency responders, as well as a secondary method for emergency evacuation. Key findings of the NIST Final Report of the National Construction Safety Team on the Collapse of the World Trade Center Towers can be found on the NIST website at www.nist.gov. Chapter 9 Recommendation 18 indicates 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 elevator shafts… should have adequate structural integrity to withstand accidental structural loads and anticipated risks."

Shaft enclosures provided for exit stairways and elevator hoistways should be designed to be as robust as possible in order to withstand the dynamic effects of an out of control fire. Unfortunately, the E119 fire endurance test by itself does not replicate the types of physical insults a wall may suffer during a fire. The fire test furnace is a rather static environment in which the test wall is exposed to natural gas burner flames (that don't even impinge on the wall) under a slightly negative pressure differential, whereas real fire situations are normally very dynamic and occur under positive pressure conditions within compartments of buildings. Because the fire test furnace does not replicate real fires, it was determined that some type of physical stress test was needed as part of the ASTM E119 test method. The hose stream test was determined to be the most appropriate method for evaluating the relative robustness, i.e. strength, integrity, and impact resistance, of fire resistance rated wall assemblies. In fact, Section 11.1 of the E119 Test Method states that "The hose stream test shall be conducted to subject the specimen…to the impact, erosion, and cooling effects of a hose stream." Also, the Appendix X5. Commentary Section X5.9 Integrity states: "In this hose stream test, the ability of the construction to resist disintegration under adverse conditions is examined."

Not only are actual fire hose streams employed by fire fighters during their activities on the fire scene, but there are other impacts and stresses that may be imposed on walls such as:

Falling debris including ceilings and fixtures
Collapsing shelving and storage racks
Thermal expansion of the wall
Differential movement between the wall and the supporting floor and restraining walls and floor/roof above
Explosions
Liquid pool fires or similar fire exposures that can result from burning plastics, which have a rapid temperature rise and more severe upper layer gas temperatures
Projectiles such as aerosol cans, pressurized gas cylinders, and other pressure sealed containers

The hose stream test is an attempt to address some of the dynamics of a real fire scenario since it applies stresses, including orthogonal loading to the wall assembly, immediately after the fire endurance test has been completed and the wall is weakest.

Because the use of fire resistance wall varies, the ASTM E119 test method includes 3 options for applying the hose stream test as follows:

1. No hose stream test is required for walls that have a fire resistance rating of less than one hour. (Section 11.1.1)
2. The hose stream test is applied to a duplicate wall assembly which is fire tested for one-half the fire resistance rating period of the original wall assembly, but not to exceed one hour. (Section 11.2) Thus, walls having a fire resistance rating greater than 2 hours need only be retested for one hour for the application of the hose stream test.
3. The hose stream test may be applied at the end of the fire test. (Section 11.3)

We believe that this proposal which invokes the third option is an appropriate performance provision for assuring an enhanced robustness and integrity of the shaft enclosures for exit stairways and elevator hoistways in super high-rise buildings. That is because, generally speaking, walls of solid construction with adequate thickness, such as concrete and masonry walls, can readily pass the hose stream test when it is applied at the end of the fire endurance test. However, most framed walls which are designed to just meet the fire resistance ratings required by the code generally can not. Those walls are accommodated by Option 2 for the hose stream test as indicated above.

We believe the structural integrity issue goes beyond the problems associated with the stairway shaft enclosures and elevator hoistway shaft enclosures in the World Trade Center tragedies. This is especially critical since the NIST report has estimated that the fire department response using stairs to gain access to the 58th floor of a hypothetical 60 story building to effect fire fighting operations and rescue would require at least 90 minutes if the fire department personnel did not carry any equipment or breathing apparatus and as much as 125 minutes if they were carrying equipment and breathing apparatus. Furthermore, it has been estimated that the evacuation of a fully occupied World Trade Center Tower would take approximately 4 hours. Thus, it is critical that not only do the shaft enclosures resist fire exposure for the specified 2 hours but they demonstrate adequate structural integrity to be able to withstand the dynamics of a fire condition involved in an uncontrolled fire in a building.

Providing this additional level of physical performance for shaft enclosures of exit stairways and elevator hoistways in super high-rise buildings is essential for life safety. These super high-rise buildings will likely require staged evacuations necessitating that the exit stairways and elevator shaft enclosures remain in place for very extended periods of time during a fire. The hose stream test proposed in this code change proposal will help to provide that additional factor of safety.

Staged evacuations become necessary in super high-rise buildings because of the extremely high occupant loads which make total evacuation impractical within a reasonable period of time. An example of the very high occupant loads that can occur in super high-rise buildings follows. Take a typical office building having a floor plate of 10,000 sq. ft. per floor. The resultant calculated occupant load for each floor is 100 based on Table 1004.1.2 which specifies that business areas (offices) have an occupant load of 100 gross sq. ft. per occupant. A 420 foot tall building having a story height of approximately 13 feet per story would contain approximately 32 stories. Thus, the total occupant load of the building would be equal to 100 occupants per story times 32 stories which is 3,200 occupants. This the equivalent of a small community. This is further exacerbated if there is an assembly occupancy located on the top of the building which would not be unusual. In that case, the occupant load can be significantly higher. For example, take the same typical office building and locate a 7,500 net sq. ft. restaurant in the top story. Based on an occupant load of 15 sq. ft. net per occupant, there would be 500 more occupants (15% more) added to the occupant load calculated above which could be even more if the restaurant contained a bar area as well. This would result in a total occupant load of 3,700 people.

Along with the high occupant loads comes a large number of mobility impaired occupants. These occupants can constitute as much as 10% or more of the total occupant load depending upon the use of the building. For the typical example we cited above, this means there could be as many as 320 mobility impaired occupants in the office portion of the building and 50 in the restaurant portion for a total of 370 mobility impaired occupants. Obviously, this large number of mobility impaired occupants will increase the evacuation time and put greater pressure on the rescue operations of the responding fire department, requiring additional resources and time to assist those mobility impaired occupants in evacuating the building or moving to a suitable area of refuge within the building. Thus, it is critical that the shaft enclosures provided for the exit stairways and elevator hoistways be able to withstand the effects of an out of control fire in a super high-rise building.

In conclusion, we believe that this code change will provide an important enhancement to the level of fire and life safety provided in buildings greater than 420 feet in height by mandating that the shaft enclosures for the exit stairways and elevator hoistways in those buildings be more resistant to the dynamic forces that occur during an uncontrolled fire by requiring such walls to have their fire resistance rating determined in accordance with ASTM E119 with the application of the hose stream test conducted at the end of the fire resistance rating period for the fire endurance test in that test method.

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

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

G74–06/07

IBC 403.15 (New), [F] 909.2 (IFC 909.2), 909.20.2.1(New), 909.20.2.2 (New)

Proponent: Tony Crimi, A.C., Consulting Solutions Inc., representing International Firestop Council

THIS PROPOSAL IS ON THE AGENDA OF THE IBC GENERAL AND THE IBC FIRE SAFETY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IBC GENERAL

1. Add new text as follows:

403.15 Stair pressurization. Every required interior exit stairway serving floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall comply with the relevant provisions of Sections 909.20 and 1020.1.7, and shall be pressurized to a minimum of 0.15 inch of water (37 Pa) and a maximum of 0.35 inch of water (87 Pa) in the shaft relative to the building measured with all stairway doors closed under maximum anticipated stack pressures.

2. Revise as follows:

[F] 909.2 General design requirements. Buildings, structures or parts thereof required by this code to have a smoke control system or systems, or a stair pressurization system shall have such systems designed in accordance with the applicable requirements of Section 909 and the generally accepted and well-established principles of engineering relevant to the design. The construction documents shall include sufficient information and detail to adequately describe the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied by sufficient information and analysis to demonstrate compliance with these provisions.

PART II – IBC FIRE SAFETY

Add new text as follows:

909.20.2.1 Stair pressurization ducts. Ducts used to supply uncontaminated air for pressurized interior exit stairways required by Section 403 shall be a classified and labeled materials, systems, methods of construction, or products specifically evaluated for such purpose, in accordance with nationally recognized standards for such fire resistive enclosure systems.

909.20.2.2 Stair pressurization duct penetrations. Penetrations by stairwell pressurization ducts through a ceiling, wall or floor from the inlet terminal to the outlet terminals shall be protected in accordance with Section 712 with a through-penetration fire stop system having an F and T rating equal to the fire-resistance rating of the assembly being penetrated.

Reason: To introduce Code language which would require Stair pressurization for all high rise buildings with required interior stairwells serving floors over 75 ft, and introduce performance requirements for the protection of pressurized supply air duct systems.

Stair pressurization to provide uncontaminated air within required interior exit stairwells in high-rise buildings should be required in all cases, regardless of whether the building is sprinklered or not. In order to ensure the continuity of fresh air supply, air ducts to the interior stairwells need to be protected from the effect of fire, or constructed as fire resistant systems.

Smoke control systems have been required in nearly two thirds of the United States for over a decade. Conversely, the IBC does not require stairwell pressurization in high-rise buildings, and only requires smoke control in underground buildings, atriums, and covered mall buildings. Section 403.13 of the 2006 IBC requires Smokeproof exit enclosures for high-rise buildings in every required stairway serving floors more than 75 feet (22.86 m) above the ground. Section 909.20.5 permits sprinklered Buildings to use stairwell pressurization as an alternate to the smokeproof enclosures. As a first step, the IBC needs to provide more effective means to prevent smoke from entering critical exit stairwells in high-rise buildings. Pressurization results in airflows of high velocity in the gaps around closed doors and construction cracks, thereby preventing smoke from flowing back into the pressurized space through these openings. Pressurized stairwells are provided with the goal of maintaining a tenable environment within the escape routes in the event of a building fire.

Smoke can behave very differently in tall buildings than in low buildings. The predominant factors that cause smoke movement in tall buildings are stack effects, the affect of external wind forces, and forced air movement within the building. Smoke removal and venting practices are complicated by stack effects, which will tend to favour natural air movement vertically through the building as a results of differences in temperature and densities between the inside and outside air. [1]

During the final hearing for the 2003 IBC, the majority of the voting membership voted to support engineered smoke control in high-rise buildings, narrowly missing the two thirds majority required to overturn the committee's recommendation for disapproval. Clearly, many building officials recognize the obvious problem with tall buildings and the challenge of controlling smoke. This proposal seeks to introduce Stairwell pressurization in every required stairway serving floors more than 75 feet (22.86 m) above the ground using the existing design requirements of Section 909 of the IBC.

Several incidents in North America during the past 40 years have demonstrated that serious fires can occur in modern high-rise buildings, that these fires can generate tremendous quantities of smoke, and that smoke can spread rapidly throughout these buildings. Most notable were the 1970 One New York Plaza fire, the1973 Hyatt Regency O'Hare Hotel fire, the 1980 MGM Grand Hotel in Las Vegas, a 1981 fire in North York Ontario at the Inn on the Park Hotel, the 1983 First Canadian Place in Toronto, Ontario, One Meridian Plaza, Philadelphia, Pennsylvania and the First Interstate Bank in Los Angeles, California in the 1990's.

More recently, the NIST Reports on the World Trade Center disaster discuss various aspects of the post impact condition of the exit stairwell. The NYC Building Code did not require stairwell pressurization in sprinklered buildings. However, the *NIST NCSTAR 1-7, WTC Investigation Report* contains the following quotations and comments:

"A survivor from a floor in the 20s in WTC 1: "The stairwell was lit the entire way down. There was a grayish color smoke which smelled like fuel. The more we reached the lower floors the stronger the smell became. On the 6th floor, the sprinklers were on, which slowed us down because we wanted to be cautious and not slip or fall." Interview 1000044 (NIST 2004)"[2]

"The explosion significantly damaged floors, walls, and doorways in subgrade levels and forced large amounts of smoke well away from the immediate area. In one report, visibility was reduced to 0.3 m (1 ft) within about 1 min at the 44th floor of WTC 1, largely through the spread of smoke in elevator and stairwell shafts (Isner and Klem 1993b). Before beginning evacuation, many occupants experienced smoke on occupied floors and encountered even heavier smoke as they descended the buildings in the stairwells." [2]

This proposed Code change also introduces language into the IBC to address systems used for covering and protection of these pressurization HVAC air ducts. The text is similar to the language that had previously been used for grease duct enclosures assemblies in the IMC. In November of 2005, ICC-ES approved the publication of AC 179, <u>Acceptance Criteria for Metallic HVAC Duct Enclosure Assemblies</u>, which can be used to evaluate products used for these applications. The purpose of the acceptance criteria is to establish requirements for fire protection enclosure systems applied to metallic HVAC ducts, as alternatives to shaft enclosures for vertical ducts with required fire-resistance-rated shafts under specified conditions, with limitations on their application. The criteria also provide an alternate to fire dampers in horizontal ducts (penetrating fire barriers, fire partitions, and or smoke barriers) and vertical ducts connecting not more than two stories.

AC 179 evaluates the enclosure materials and the HVAC duct enclosure systems using the following test methods: Flame spread, smoulder resistance, a fire engulfment test based on ISO 6944 with a through-penetration fire stop, durability tests, and thermal conductivity. Work is currently underway on the development of an ASTM Consensus Standard for this application, but until such time as that process is complete, the proposed language incorporated here will provide a means of evaluating the performance of these products and systems, which are becoming more widespread in their use, while not restricting the choice of acceptable solutions available to designers.

High-rise buildings constructed to the requirements of International Building Code, but without any specific measures to control smoke migration, are all the more vulnerable to property damage and occupants' loss of life. In reality, all the available research indicates that the need for smoke control is more pressing in tall buildings that in any other type of construction. As a minimum, the IBC needs to provide more effective means to prevent smoke from entering critical exit stairwells in high-rise buildings.

Bibliography:

[1.] Klote, J.H. and Milke, J.A. Fire Protection Handbook, NFPA 19th Edition, Volume II, Smoke Movement in Buildings, Chapter 6, Section 12-113 – 12-126

[2] NIST NCSTAR 1-7 (Draft), Federal Building and Fire Safety Investigation of the World Trade Center Disaster Occupant Behavior, Egress, and Emergency Communications (Draft)

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

Analysis. While Section 909.2 is typically the purview of the Fire Code Development Committees, for consistency, the General Committee will make the determination for Part I of this proposal.

PART I – IBC GENERAL

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

PART II – IBC FIRE SAFETY

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

G75–06/07

403.15 (New)

Proponent: Lorin Neyer, Office of Statewide Health, Planning & Development, State of California

Add new text as follows:

<u>**403.15 Smoke management.** Each story shall be provided with an approved means to restrict smoke originating from a fire in the story from spreading to any other story in the building utilizing the design criteria in Section 909. The approved means shall be capable of exhausting the smoke to the exterior without recirculating to other stories.</u>

Reason: Our organization believes that smoke management is an essential component of an overall fire protection strategy for protecting against unwanted fires in high-rise buildings. In California we have had the requirement for smoke management/control in high-rises since we first incorporated provisions for high-rise buildings in the 1970s. They have proven to be a very important and useful tool in our fire fighting operations since they have the ability to limit the smoke from an unwanted fire to the story of origin, minimizing its spread to adjacent stories and exit paths. It provides a tool for property protection, as well as for life safety, by preventing smoke exposure to occupants on floors remote from the fire and by containing the smoke so that it does not cause damage which can be very significant, especially to sensitive electronic equipment that is found in many buildings today.

The approach we have taken by proposing this requirement for smoke management is to keep the system simple when we refer to Section 909. Our approach is to provide the performance criteria that simply restricts the smoke from a fire from spreading to any other story in the building using an approved means which is capable of exhausting the smoke to the exterior without having it recirculated to other stories. This was the basic concept behind smoke control requirements in our current legacy model building code, the 1997 ICBO Uniform Building Code (UBC). We believe that if we can contain the smoke to the fire floor of origin, we have a better chance of containing the fire and its impacts, as well as in evacuating the occupants to safe areas of refuge within the building or completely out of the building without having to deal with a panic situation. Our experience has shown that smoke can cause extensive property damage and often requires buildings to be shut down for long periods of time while they are rehabilitated and cleaned to eliminate the smoke damage and the smoke odor.

These systems also help us to mop up the fire scene and release our personnel earlier from the fire ground so that they are available for other emergency calls in our communities. It is often a challenge to deal with smoke in high-rise buildings since we cannot use the traditional methods of ventilating through the roof for obvious reasons. A simple basic smoke management system can provide the fire department with the necessary tools to contain smoke to the floor of origin and eventually exhaust it from the building with minimal man-power required to accomplish the task. This is especially important in today's economic climate in our state where there is not a lot of money available to invest in the fire department and their personnel, so we have to get by with minimal manning to provide the necessary services expected by our citizens. Certainly, a smoke management system is one way we can better accomplish our mission in a way that also provides a higher level of fire and life safety protection to the building and its occupants. Therefore, we encourage the Committee to approve this code change proposal to require a means of smoke management in high-rise buildings.

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

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

G76–06/07
403.15 (New), 708.1

Proponent: Lorin Neyer, Office of Statewide Health, Planning & Development, State of California

1. Add new text as follows:

<u>**403.15** **Tenant separations.** For buildings greater than 420 feet in height, walls and partitions used to separate adjacent tenant spaces shall be constructed as 1-hour fire-resistance rated fire partitions complying with Section 708.</u>

2. Revise as follows:

708.1 General. The following wall assemblies shall comply with this section:

1. Walls separating dwelling units in the same building.
2. Walls separating sleeping units in occupancies in Group R-1 hotel, R-2 and I-1 occupancies.
3. Walls separating tenant spaces in covered mall buildings as required by Section 402.7.2.
4. Corridor walls as required by Section 1017.1.
5. Elevator lobby separation as required by Section 707.14.1.
6. Residential aircraft hangars.
7. <u>Walls separating tenant spaces in high-rise buildings greater than 420 feet in height as required by Section 403.15.</u>

Reason: This code change applies to high-rise buildings greater than 420 feet tall. Such buildings must be able to withstand the impact of an uncontrolled fire which may completely burn out in the event that the water supply fails to the building. Such a failure could be either internally or externally. This is because fire department apparatus is generally not capable of supplying adequate water pressure and flow to floors located above 420 feet in height. So if the public water supply fails, then there is no practical means for fighting a fire on those upper floors of such buildings, so the building must be able to stand on its own.

These very tall buildings should also provide additional protection for the occupants who may have to wait for long periods of time to evacuate or to be rescued depending upon the severity of the fire and the demands on the responding fire department, as well as the exiting system in the building. One way of achieving the additional degree of protection for the building occupants is to provide for 1-hour fire resistive rated partitions to separate adjacent tenants. For example, these partitions are already required for multiple tenant buildings in Group R occupancies since the dwelling units and hotel sleeping rooms are required by Section 708.1 to be separated from each other by fire partitions having a 1-hour fire resistance rating. This code change proposal would simply extend that concept to these very tall buildings to include other occupancy types where multiple tenants are located on a floor so that they are afforded the same degree of protection from fire.

These tenant separations serve an important function of protecting adjacent tenants from their neighbors should the neighbor suffer a fire. These separations provide not only for property protection to minimize the impact of an adjacent fire by containing it until the fire department can respond, control, and eventually extinguish the fire, but also for life safety purposes by providing the adjacent tenants additional time to become aware of a fire condition in an adjacent space and appropriately responding to evacuate the building. The tenant space can also serve as an “area of refuge” for those occupants who can not readily escape and need to wait for rescue.

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

Analysis: The action on the proposed change to Section 708.1 is dependent on the decision of the General Committee to Section 403.15, therefore, for consistency, the General Committee will make the determination for this section instead of the Fire Safety Committee.

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

G164–06/07
602.1

Proponent: Susan Lamont, Arup Fire, San Francisco, CA

Revise as follows:

602.1 General. Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5. The building elements acting as single members shall have a fire-resistance rating not less than that specified in Table 601 and exterior walls shall have a fire-resistance rating not less than that specified in Table 602. Alternatively and where approved by the local authority the structural frame acting as a whole or part assembly shall be shown by global structural analysis to have a fire resistance rating that meets the intent of the life safety requirements of this code which may be equivalent to or greater than that that specified in Table 601.

When a whole or part assembly is assessed in a global structural analysis for the fire situation, a series of credible worst case fires, the relevant heat transfer calculations, the relevant failure modes during fire exposure, the relevant loads, the temperature-dependent material properties and member stiffness as well as the effects of thermal expansions shall be taken into account. The impact of structural deformations on compartmentation shall also be considered by the design. The calculations should be carried out using the standard time-temperature curve or an agreed set of design basis fires as appropriate taking into account credible fire load, compartment dimensions, properties of wall linings and the percentage of unprotected openings.

Reason: The purpose of the code change is to include new text such that performance based design of structural steel frames can be proposed on projects. This means that the IBC would allow performance based design for fire resistance similarly to other international codes for example in the UK, Europe and Australia. Also to recognize that the performance of structural members in a real fire can be very different to the fire resistance of single members i.e. a beam, column or slab acting in isolation of the rest of the frame in a standard furnace.

This is important because savings in structural fire protection can be made when structures are robustly designed but also weaknesses in the structural frame which can exist when thermal expansion forces act on a structure during a fire can be identified and designed against. This is particularly important in innovative structural design and iconic buildings which are generally much taller or have longer spans and cannot be adequately tested in standard furnace tests. The methodology however is applicable to any structure.

The recommendations in the IBC for fire resistance are based on single element tests in a standard furnace. Although this approach is an essential requirement of the regulatory system and enables engineers, manufacturers and building officials to compare the relative performance of different structural components and materials for a range of fire resistance periods it does not represent the real response of structures in real fires. The fire is not necessarily representative of many credible worst case fires and the forces induced in single elements in a furnace can be very different to those induced as a result of restrained thermal expansion and alternative load paths in a highly redundant frame.

As the understanding of the science of fire develops, and its resulting effect on materials and structure, more advanced validated tools are becoming available for engineers for use in the design process.

It is becoming increasingly clear through research and performance based design projects that designing structures with the single aim of protecting structural materials to meet the code requirements for hourly fire resistance, may result in intrinsic weaknesses within the structural stability system. Alternatively it can mean ignoring intrinsic strengths. Passive fire protection simply delays the heating of steel members it does not eliminate it thus protected steel members still get hot and expand. This expansion allows floors to reach high deflections which can be beneficial because alternative load paths exist such as catenary action in beams or tensile membrane action in slabs. However expansion also generates forces and moments which the primary structure, particularly the columns have to resist and were never designed or tested to resist.

The sole aim of structural fire engineering proposed in the code change is to quantify the response of the proposed “cold temperature” structural design, in realistic fire scenarios, in order to determine if this response is acceptable. Strengths and weaknesses can then be clearly identified and addressed within the design, as appropriate.

In the investigation of the WTC collapse NIST set out a series of recommendations to be considered in code development. One of these (recommendation 9) specifically addresses the need to calculate structural fire response in design of tall or innovative buildings.

Research into the fire response of structures has been developing for many years ever since the first standard furnace test over 100 years ago. The understanding of the whole frame response to fire has however increased rapidly in the last 15 years with the Broadgate Fire (a multi- storey composite steel frame caught fire at night during construction when most of the steel frame was unprotected and remained standing after a severe post-flashover fire) in the UK, the detailed analysis of the Cardington 8-storey composite steel frame fire tests in the UK and Europe, similar tests and research in New Zealand and Australia, and onwards to the analysis of the WTC collapse on 9-11 by NIST and others, and currently the recent Torre Windsor fire in Madrid, Spain.

The Cardington Frame tests enabled engineers to measure temperatures and deflections in a whole series of compartment fire tests where the steel beams were left unprotected on a real composite steel frame and temperatures in the compartment exceeded 1000C for up to an hour. The tests and subsequent modeling of the tests showed that alternative load carrying mechanisms develop in fire when the composite slab and beams deflect as a result of thermal expansion and thermal bowing. These mechanisms allow the gravity and live loads to be supported in catenary action in the beams and tensile membrane action in the slab. For the 9m span beams which formed the Cardington Frame failure of the structure was not observed even in the largest post-flashover compartment fires.

Recent research is now considering longer spans (up to 21m) and different steel members such as trusses or deep beams with many penetrations in the web which typically heat more quickly than hot-rolled beam sections. As at Cardington there are alternative load paths but the much larger deflections as a consequence of the longer spans, need to be addressed and sometimes simply protecting the member in accordance with prescriptive rules is not necessarily the best solution.

Arup Fire already use finite element analysis techniques validated for fire by the Cardington Large Building Test Frame program, and more recently used to quantify the WTC collapse sequence, in design.

The references and standards listed in the Bibliography below outlines the background and the basis of the performance based design methodology proposed, the reasons why it is important for design and appropriate validation for software.

The contents of the references can be summarized as follows;

A four step approach is required for a global structural fire analysis as follows:

a. determine reasonable design basis fire scenarios
b. quantify the heat transfer from these fires to representative structural elements
c. quantify the mechanical response of the elements for the entire duration of the fire
d. determine appropriate passive fire protection and/or structural detailing based on this response

The fire size is the main input to a structural fire analysis. The Design Fires proposed should address (a) the quantity of fuel available (b) the quantity of ventilation through the glazed façade, c) compartment dimensions and d) properties of the wall linings.

Heat transfer analyses provide the temperature variation with time along the length and through each section of all structural materials during the fire exposure. It is from this data using a fully validated non-linear finite element analysis package that the mechanical response of the structure to the fire can be quantified.

The software used for heat transfer and structural analysis needs to be validated against full scale test data for example the Cardington frame fire tests.

The design approach is important to calculate the structural response of buildings to fire because current prescriptive rules ignore the forces generated in building elements by thermal expansion therefore design teams can either over design members or ignore inherent weaknesses. Many of the innovative structures developed by design teams with long spans for example cannot be adequately tested in a standard furnace.

This approach is described in British Standards, Eurocodes and design guides in Australia, New Zealand and around the world. It is most widely used in the UK and Europe because the fundamental research was conducted there but the methodology can be applied to performance based design in any country.

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Cost Impact: The code change proposal will not increase the cost of construction unless the structural design is such that it is particularly susceptible to fire in which case changes to the design may be necessary. In most cases these changes can be offset by savings in passive fire protection to secondary members which have been shown by the performance based analysis to be redundant.

Analysis: There are related code changes submitted by this proponent to the IBC FS committee.

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

E80–06/07

1011.2 (New), 1011.2 through 1011.5.1.3, 1011.6.4 (New), [F] 2702.2.3 (IFC [B] 1011.2 (New), [B]1011.2 through 1011.5.1.3, [B]1011.6.4 (New), 604.2.3)

Proponent: Timothy C. Barncord, Safeway Lighting/Duraled Lighting Technologies, Corp.

1. Add new text as follows:

1011.2 Exit light strips. Where exit signs are required by Section 1011.1, exit and exit access doors shall also be marked by an approved exit light strips readily visible from any direction of egress travel. Access to exits shall be marked by readily visible exit light strips in cases where the exit or path of egress travel is not immediately visible to the occupants. Exit light strips would be place around the perimeter of the door frame, to 12 inch (305 mm) minimum from the floor level on each side.

2. Revise as follows:

~~**1011.2**~~ **1011.3 Illumination.** Exit signs and light strips shall be internally or externally illuminated.

> **Exception:** Tactile signs required by Section 1011.3 need not be provided with illumination.

~~**1011.3**~~ **1011.4 Tactile exit signs.** A tactile sign stating EXIT and complying with ICC A117.1 shall be provided adjacent to each door to an egress stairway, an exit passageway and the exit discharge.

~~**1011.4**~~ **1011.5 Internally illuminated exit signs and light strips.** Internally illuminated exit signs shall be listed and labeled and light strips shall be installed in accordance with the manufacturer's instructions and Section 2702. Internally illuminated exit light strips shall be installed in accordance with the manufacturer's instructions and Section 2702. Exit signs and light strips shall be illuminated at all times.

~~**1011.5**~~ **1011.6 Externally illuminated exit signs and light strips.** Externally illuminated exit signs shall comply with Sections ~~1011.5.1~~ 1011.6.1 through ~~1011.5.3~~ 1011.6.3. Light strips shall comply with Sections 1011.6.2 through 1011.6.4.

~~**1011.5.1**~~ **1011.6.1 Graphics.** Every exit sign and directional exit sign shall have plainly legible letters not less than 6 inches (152 mm) high with the principal strokes of the letters not less than 0.75 inch (19.1 mm) wide. The word "EXIT" shall have letters having a width not less than 2 inches (51 mm) wide, except the letter "I," and the minimum spacing between letters shall not be less than 0.375 inch (9.5 mm). Signs larger than the minimum established in this section shall have letter widths, strokes and spacing in proportion to their height. The word "EXIT" shall be in high contrast with the background and shall be clearly discernible when the means of exit sign illumination is or is not energized. If a chevron directional indicator is provided as part of the exit sign, the construction shall be such that the direction of the chevron directional indicator cannot be readily changed.

~~**1011.5.2**~~ **1011.6.2 Exit sign and light strip illumination.** The face of an exit sign and light strip illuminated from an external source shall have an intensity of not less than 5 foot-candles (54 lux).

~~**1011.5.3**~~ **1011.6.3 Power source.** Exit signs and light strips shall be illuminated at all times. To ensure continued illumination for a duration of not less than 90 minutes in case of primary power loss, the sign and light strip illumination means shall be connected to an emergency power system provided from storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702.

> **Exception:** Approved exit sign and light strip illumination means that provide continuous illumination independent of external power sources for a duration of not less than 90 minutes, in case of primary power loss, are not required to be connected to an emergency electrical system.

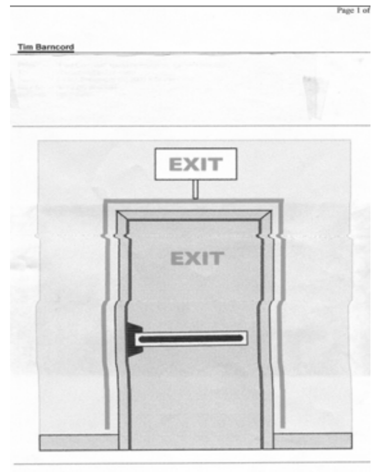
3. Add new text as follows:

1011.6.4 Design. Light strips shall have a width of at least 1 inch (25 mm) but not more than 2 inches (51 mm) and be securely attached to the door frame or the wall within 4 inches (102 mm) of the outside edge of the door frame.

4. Revise as follows:

[F] 2702.2.3 (IFC 604.2.3) Exit signs and light strips. Emergency power shall be provided for exit signs and light strips in accordance with Section 1011.5.3.

Reason: As a firefighter for the last 24 years, the nightclub fire that killed over one hundred people in West Warwick, Rhode Island on February 20th, 2003 greatly affected me. Later the fire was proclaimed the fourth deadliest nightclub fire in United States history. Most of the fatalities were found mere feet away from an exit that would have led them to safety. After viewing the videotape, a major problem with the lighting of the emergency exits signs became obvious to me. Current emergency exit signs are inadequate in a smoke filled room or building because of their location. Exit signs are at the ceiling level where smoke would make it hard to see them. If there were exit light strips in addition to the exit signs, exits would become easier locate. Therefore, a number of lives, including firefighters, would be saved. The IBC change that I am proposing would make all possible exits easily seen from all angles to aide in an escape from a fire situation. This code change would complete my mission as a firefighter to save more lives.



Bibliography:
www.nfpa
www.post-gazette.com

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

Analysis: The action on the proposed change to Section 2702.2.3 is dependent on the decision of the Means of Egress Committee to the remainder of the proposal, therefore, for consistency, the MEO Committee will make the determination for this section instead of the IFC Committee.

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

E85–06/07
1011.6 (New) [IFC [B] 1011.6 (New)]

Proponent: Vincent "VJ" Bella, Retired State of Louisiana State Fire Marshal, representing himself

Add new text as follows:

1011.6 Floor proximity path markings. A listed and labeled floor proximity path marking system shall be installed not more than 8 inches (203.2 mm) above the floor, marking the path of egress travel. The floor path marking system and approved low-level exit signs shall provide a visible delineation of the path of travel along the designated exit access and be essentially continuous, except as interrupted by hallways, corridors or other architectural features. Path marking materials shall include, but not be limited to electrical, photoluminescent or self luminous material. Such markings shall become visible in an emergency and path marking systems shall be activated by the automatic fire detection system in accordance with Section 907.2.11.2.

Exceptions:

1. Floor proximity path markings are not required in the following occupancies: Group A with occupancy less than 300, F, H, M, R-3, R-4, S and U
2. Main exit passageways greater than 15 feet (4572 mm) in width leading to exterior exit doors which obviously and clearly are identifiable such as in atriums and foyers, need not have floor path marking.

Performance of floor proximity path marking systems shall be consistent with the exit signs requirements of each similar type in accordance with Section 1011.

Reason:

- Events like 9-11, the Warwick Station Nightclub Fire and others demonstrate the need for getting people out of a building more quickly and safely.
- During a fire, smoke rises. As the exit signs located above doors very quickly become obscured by smoke, low level exit signs and directional floor path markings will continue to be visible to aid occupants safely to egress.
- Not all exits are efficiently used in emergency situations. Floor proximity path markings reinforce the effectiveness of the already existing emergency exit system, ensuring occupants are aware of all routes and exits.
- The same system that will allow people to get out of a building will also provide safety for firefighters and emergency personnel getting in to rescue people and fight the fire and will work in power outages that are not necessarily emergencies.
- NIST (National Institute of Standards & Technology), a US government agency, released its report on March 3, 2005 on the Station Nightclub fire with Recommendation 3.e: "The factor of safety on the time to egress should be increased in the model code by providing improved means - such as exit signs near the floor and floor lighting- for occupants to locate emergency routes once standard exit signs become obscured by smoke."
- Referenced section 411.7 Exit Markings requiring approved low-level exit signs and directional path markings.
- The NFPA 101 Life Safety Code is one source that provides basic functional requirements for Floor Proximity Egress Path Marking Section 7.10.1.7 which reads:

  Where floor proximity egress path marking is required in Chapter 11 through Chapter 42, a listed and approved floor proximity path marking system that is internally illuminated shall be installed within 455mm (18 in.) of the floor. The system shall provide a visible delineation of the path of travel along the designated exit access and shall be essentially continuous, except as interrupted by doorways, hallways, corridors, or other such architectural features. The system shall operate continuously or at any time the building fire alarm system is activated. The activation, duration and continuity of operation of the system shall be in accordance with 7.9.2.

- Some state codes and jurisdictions have begun adopting floor proximity path marking and low level exit signs**,** but without widespread adoption of such systems in national code, there is a lack of a single standard or design guide on where to place markings for different types of buildings.

a. The State of California, adopted the following code in 1991:

   1013.5.la Path Marking. When exit signs are required by Chapter 10, in addition to approved floor-level exit signs, approved path marking shall be installed at floor level or no higher than 8 inches (203 mm) above the floor level in all interior rated exit corridors of unsprinklered Group R, Division 1 and unsprinklered Group A Occupancies. Such marking shall be continuous,except as interrupted by doorways,corridors or other such architectural features in order to provide a visible delineation along path of travel.

b. In June of 2004, the New York City Council passed NYC Introduction Bill 0126-2004 which implements recommendations from the World Trade Center Building Code Task Force. This law is limited to only photoluminescent markings and a specific reference standard has been developed to govern where the markings need to be placed and minimum performance levels. *b) Exit path markings in high rise office buildings and in occupancy group E high rise buildings. On and after January 1, 2006 all high rise office buildings and all high rise buildings classified in occupancy group E shall have exit path markings conforming to this subdivision. This provision shall be retroactive and shall apply to buildings constructed on and after such date and to buildings in existence on such date. All exit path markings required herein shall be of an approved photoluminescent material which shall be capable of remaining visible in total darkness for a period of at least eight hours after exposure to normal lighting conditions. The markings shall be washable, non-toxic, non radioactive, and if subjected to fire must be self extinguishing when the flame is removed.*

c. The State of MA Task Force on Fire & Buildings Safety issued a report in September 2003 and is now in the process of executing the recommendations including, *Section III, Section B. Egress Recommendation #4) The Board of Building Regulations & Standards should study methods to enhance exit identification in all buildings used for public assembly purposes and incorporate these improvements in the upcoming 7th edition of the State Building Code. Topics for study should include low-level lighting that leads to each exit, outlining exit doors with luminescent marking, distinctive exit sign lighting, and scheduled testing and maintenance for the operation of exit signs and lights.*

d. The State of Connecticut adopted Floor Proximity Exit Signage requirements in its 2005 Building Code and then introduced legislation in the 2006 legislative session to mandate later adoption of Floor Proximity Exit Lighting. The bill has left committee and will be voted on in the current with wording as follows:

(Effective October 1, 2006) Not later than October 1, 2007, the State Building Inspector and the State Fire Marshal, in conjunction with the Codes and Standards Committee, shall make amendments to the State Building Code and the State Fire Code concerning floor proximity path marking devices or related devices intended for installation as a system to identify the path of emergency egress. Such amendments shall require that a path marking system be installed within eighteen inches of the floor, and provide a visible delineation of the path of travel along the designated exit access and be essentially continuous, except as interrupted by doorways, hallways, corridors or other architectural features. The amendments shall provide which materials may be used for path

marking and such materials shall include, but not be limited to, electrical photoluminescent or self luminous material. Such amendments shall apply to all new construction in (1) Group A occupancies with an occupant load of more than three hundred persons, (2) Group B medical occupancies, (3) Group E occupancies, (4) Group I-1 occupancies, (5) Group I-2 occupancies, (6) Group R1 hotels and motels, and (7) Group R-2 dormitories

e. The State of Rhode Island enacted new fire code in the aftermath of the Warwick tragedy that requires Floor Proximity Exit Signs in assembly occupancies with a loading of more than 150 persons.

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- March 3, 2005 National Institute of Standards and Testing (NIST) Key Findings and Recommendations for Improvement - NIST Investigation of The Station Nightclub Fire
- Video of NIST Test Simulation of the Station Nightclub Fire
- UL Standard 1994 "Floor Proximity Path Marking" Summary
- SINTEF NBL - Norwegian Fire Research Laboratory - 1993 study of evacuation from buildings in smoky conditions - Published in Gemini Magazine
- FIREPRO Consultants opinion letter regarding Floor Proximity Path Marking
- Fairfield, CT Chief Richard Felner letter reporting on rescue tests conducted with path marking
- Text from New York City Law 126 requiring Path Marking in High Rise Office Buildings
- CT State Legislature Bill Proposal - 2005 Session
- MA State Task Force Recommendations for Floor Proximity Path Marking
- International Maritime Organization (IMO) Resolution A.752(18) *Adopted on 4 November* 1993 GUIDELINES FOR THE EVALUATION, TESTING AND APPLICATION OF LOW-LOCATION LIGHTING ON PASSENGER SHIPS
- NFPA 101 Life Safety Code
- Underwriters Laboratories (UL) Standard 1994, Floor Proximity Egress Path Marking.
- International Maritime Organization (IMO) Resolution A.752(18)

Cost Impact: The code change proposal will increase the cost of construction. However the median cost of the different types of floor proximity path marking systems, would be approximately 0.1% of a project budget.

Analysis: There is also a proposal being heard by the General Committee for photoluminescent markings in Section 411, Special Amusement Buildings.

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

E141–06/07

403.14 (New); 1020.1.6, 1020.1.6.1 (New), Chapter 35 [IFC [B] 1020.1.6, [B] 1020.1.6.1 (New), Chapter 45]

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

1. Add new text as follows:

403.14 Stairway identification signs. All stairway identification signs shall be installed in all exit stairways serving occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access in accordance with Section 1020.1.6.1.

2. Revise as follows:

1020.1.6 Stairway ~~floor number~~ identification signs. A sign shall be provided at each floor landing in interior exit enclosures connecting more than three stories designating the floor level, the terminus of the top and bottom of the stair enclosure and the identification of the stair. The signage shall also state the story of, and the direction to the exit discharge and the availability of roof access from the stairway for the fire department. The sign shall be located 5 feet (1524 mm) above the floor landing in a position that is readily visible when the doors are in the open and closed positions.

3. Add new text as follows:

1020.1.6.1 Photoluminescent stairway identification signs. In buildings required to comply with Sections 403.14, each stairway identification sign shall also be required to have a photoluminscent background that complies with ASTM Standard E 2072.

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

ASTM

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

Reason: The purpose of the code change proposal is to improve the visibility of stairway identification signs under normal and emergency conditions in high-rise buildings. We believe the IBC should provide minimum requirements for when stair identification signs should be required to have a photoluminscent background. Currently the IBC does not address this issue. However, more and more jurisdictions (e.g., New York, Washington DC, GSA) are requiring stairway identification signs to have a photolunminescent background.

The proposed code change is based on current GSA requirements.

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

Analysis: There is also a proposal being heard by the General Committee for photoluminescent markings in Section 411, Special Amusement Buildings.

The standard ASTM E2072-04 has been reviewed for compliance with ICC Council Policy #28, Section 3.6. In the opinion of ICC Staff, the standard complies with ICC Criteria for referenced standards.

The action on the proposed change to Section 403.14 is dependent on the decision of the Means of Egress Committee to the remainder of the proposal, therefore, for consistency, the MEO Committee will make the determination for the entire proposal.

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

E142–06/07

403.14 (New); 1020.1.6 through 1020.1.6.6 (New), Chapter 35 [IFC [B] 1020.1.6 through [B] 1020.1.6.6 (New), Chapter 45]

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

1. Add new text as follows:

403.14 Stairway photoluminescent markings. Photoluminescent markings shall be installed in all exit stairways serving occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access in accordance with Section 10201.6.

1020.1.6 Stairway photoluminescent markings. Where required, photoluminesent markings shall be provided in all exit stairways and shall comply with Sections 1020.1.6.1 through 10201.6.6.

1020.1.6.1 Steps. A solid and continuous photoluminscent stripe shall be applied as a coating or a material integral with, the horizontal leading edge of each step and shall be installed within 6 inches (152 mm) of each side of the step.

1020.1.6.1.1 Width. The marking stripe shall have a minimum horizontal width of 1 inch but, not more than 2 inches.

1020.1.6.1.2 Consistency. The horizontal width of the marking stripe shall be consistent on each step.

1020.1.6.1.3 Leading edge, The leading edge of the marking stripe shall be installed at a maximum of ½ inch (13 mm) from the leading edge of the step.

1020.1.6.2 Landings. A solid and continuous photoluminscent stripe shall be applied as a coating or a material integral with, the horizontal leading edge of each landing and shall be installed within 6 inches (152 mm) of each side of the landing.

1020.1.6.2.1 Width. The marking stripe shall have a minimum horizontal width of 1 inch (25 mm) but, not more than 2 inches (51 mm).

1020.1.6.2.2 Consistency. The horizontal width of the marking stripe shall be consistent on each landing.

1020.1.6.2.3 Leading edge. The leading edge of the marking stripe shall be installed at a maximum of ½ inch (13 mm) from the leading edge of the landing.

1020.1.6.3 Handrails. A solid and continuous photoluminscent stripe shall be applied as a coating or a material integral with, the entire length of each handrail, including handrail extensions.

1020.1.6.3.1 Width. The marking stripe, at a minimum, shall be located at the top surface of each handrail, having a minimum width of ½ inch (13 mm).

1020.1.6.3.2 Consistency. The marking stripe shall stop at the end of each handrail. If the handrail turns a corner, the marking stripe shall continue around the corner.

> **Exception**. A maximum 4 inch (102 mm) gap without the marking stripe is permitted where handrail extensions bend or turn corners.

1020.1.6.4 Standard. The photoluminscent markings used shall comply with ASTM Standard E 2072.

1020.1.6.5 Instructions. The photoluminscent markings shall be approved and installed in accordance with the manufacturer's instructions.

1020.1.6.6 Lighting control devices. Lighting control devices that automatically turn exit stair lighting on and off based on occupancy shall not be installed where stairway photoluminscent markings are installed.

(Renumber subsequent sections)

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

ASTM

ASTM E2072-04 Standard Specification for Photoluminescent (Phosphorescent) Safety Marking

Reason: The intent of the code change is to improve the visibility of stair treads and handrails under normal and emergency conditions in high-rise buildings. Many building occupants have common visual impairments such as low vision and this proposed change will help those individual's navigating stairs. We believe that the IBC should provide minimum requirements for when exit stair photluminescent markings are installed in high-rise buildings. Currently, the IBC does not address exit stair photoluminescent markings. However, more and more jurisdictions (e.g., New York City, Washington DC, GSA, etc.) are requiring stairway photoluminescent markings that may or may not provide a safety benefit depending on the type of product used or how the product is installed.

We believe the proposed code change provides minimum requirements for exit stair photoluminescent marking products to ensure a reasonable degree of safety is provided when photoluminscent markings are installed in exit stairs. The proposed code change is based on current GSA requirements as well as the requirements recently adopted into law in New York City.

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

Analysis: There is also a proposal being heard by the General Committee for photoluminescent markings in Section 411, Special Amusement Buildings.

The standard ASTM E2072-04 has been reviewed for compliance with ICC Council Policy #28, Section 3.6. In the opinion of ICC Staff, the standard complies with ICC Criteria for referenced standards.

The action on the proposed change to Section 403.14 is dependent on the decision of the Means of Egress Committee to the remainder of the proposal, therefore, for consistency, the MEO Committee will make the determination for the entire proposal.

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

E148–06/07

1023 (New), 1003.7, 1017.1, [F] 2702.20(New) [IFC [B] 1023 (New), [B] 1003.7, [B] 1017.1, 604.2.20 (New)]

Proponent: Jeffrey Tubbs, ARUP Fire, representing himself

1. Add new text as follows:

SECTION 1023
ELEVATOR EVACUATION SYSTEM

1023.1 General. When approved and substantiated by the life safety evaluation, an elevator evacuation system shall be permitted as a portion of the means of egress system. An elevator evacuation system shall be in accordance with Sections 1023.1 through 1023.19, Section 1007 and Chapter 30. Normal use of elevators within an elevator evacuation system shall not constitute an interference with its function as a means of egress in accordance with Section 1017.1.

1023.2 Exit width. An elevator evacuation system shall be permitted to serve as a part of the exit width as required by Section 1005.

1023.3 Required exit. An elevator evacuation system shall not be considered when determining the number of required exits in accordance with Section 1015.

1023.4 Fire command center. Buildings using an elevator evacuation system shall be required to have a fire command center in accordance with Section 911 (IFC 509).

1023.5 Life safety evaluation. A life safety evaluation complying with NFPA 101 Section 12.4.1 shall be performed for buildings using an elevator evacuation system as part of the means of egress.

1023.5.1 Timed egress analysis. A timed egress analysis shall be performed to review evacuation times for a full building evacuation. This analysis should include pre-movement time and account for a certain percentage of wheelchair users in accordance with Section 1007.6.1. The analysis shall assume that phase I recall has not occurred. At least Fifty percent of elevators within an evacuation elevator system and the dedicated fire fighter elevator shall not be considered available when calculating the egress times. The calculated time for full building evacuation shall be less than or equal that required when elevators are not used as part of the means of egress. Egress width as determined by Section 1005 of this code will be used to determine the required egress width.

1023.6 Emergency communication. Elevators and associated lobbies used as part of an elevator evacuation system shall be provided with a two-way voice communication system. The voice communication system shall be capable of providing independent messages to each elevator and elevator lobby used in the system from the fire command center.

1023.7 Video surveillance. Evacuation elevators and the associated elevator lobbies shall be provided with a video surveillance system with associated video monitoring equipment located within the fire command center to allow emergency responders to view all areas of the lobby and each evacuation elevator.

1023.8 Controls. Elevators used as part of an elevator evacuation system shall be provided with controls appropriate to the evacuation plan. Controls shall also be provided within the fire command center to allow independent control of each elevator.

1023.9 Sprinkler protection. Evacuation elevators shall be permitted only in buildings protected throughout by an automatic sprinkler system in accordance with Section 903.3.1.1.

1023.10 Exit enclosures. In other than high-rise buildings, at least fifty percent of required exit enclosures within buildings using an elevator evacuation system shall be designed as smoke proof enclosures in accordance with Section 909.20. High-rise buildings shall be in accordance with Section 403.13.

1023.11 Water protection. Means shall be provided to protect elevators and elevator machine rooms used as part of an elevator evacuation system from the sprinkler system and other sources of water.

1023.12 Overheating protection. Elevator machine rooms serving an elevator evacuation system shall be provided with means to prevent overheating.

1023.13 Emergency power. Evacuation elevators used as part of an elevator evacuation system shall be provided with emergency power in accordance with Chapter 27. Other elevators shall be provided with emergency power as required elsewhere in this code.

1023.14 Fire resistance. The required fire resistance separation for shafts and elevator lobbies shall be in accordance with Section 1023.14.1 and 1023.14.2

1023.14.1 Elevator shaft separation. Elevators shafts shall be enclosed with fire barriers or horizontal assemblies with a fire resistance rating of not less than 2 hours.

> **Exception.** Where approved by the authority having jurisdiction and where substantiated by the life safety analysis and timed egress analysis, the elevator shafts used as part of an elevator evacuation system shall be permitted to be reduced to one-hour fire resistance rated fire barriers or smoke barriers.

1023.14.2 Elevator lobbies. Elevator lobbies used as part of an elevator evacuation system shall be protected with a 2 hour fire barrier.

> **Exception.** Where approved by the authority having jurisdiction and where substantiated by the life safety analysis and timed egress analysis, the elevator lobbies used as part of an elevator evacuation system shall be permitted to be reduced to one-hour fire resistance rated fire barriers or smoke barriers.

1023.15 Smoke control. Elevator lobbies and elevator shafts used as part of an elevator evacuation system shall be provided with a pressurization system in accordance with Section 909.

1023.16 Earthquake protection. Elevators used as part of an elevator evacuation system shall be provided with earthquake protection in accordance with ASME A17.1.

1023.17 Special signage. Approved special signage shall be provided to instruct occupants on the use of the elevator evacuation system.

1023.18 Fire fighter elevator. All elevators shall comply with Section 3003.2 for Phase I and Phase II recall. In buildings provided with an elevator evacuation system, at least one elevator shall be provided as an independent fire fighter elevator in accordance with Sections 1023.18.1 through 1023.18.8.

1023.18.1 Water protection. Means shall be provided to protect the fire fighter elevator and elevator machine room from the sprinkler system and other sources of water.

1023.18.2 Overheating protection. The elevator machine room serving the fire fighter elevator shall be provided with means to prevent overheating.

1023.18.3 Emergency Power. Fire fighter elevators shall be provided with emergency power in accordance with Chapter 27. Other elevators shall be provided with emergency power as required elsewhere in this code.

1023.18.4 Elevator shaft construction. The elevator shaft shall be constructed in accordance with Section 1023.14.1

1023.18.5 Elevator lobby construction. An independent elevator lobby shall be provided in accordance with Section 1023.14.2

1023.18.6 Smoke control. An independent pressurization system shall be provided in accordance with Section 909.

1023.18.7 Earthquake protection. Earthquake protection shall be provided in accordance with ASME A17.1.

1023.18.8 Special signage. Approved special signage shall be provided to instruct occupants that the fire fighters elevators shall not be used during an emergency.

1023.19 Elevator lobbies. Elevator lobbies serving evacuation elevators shall meet the requirements of areas of refuge in accordance with Section 1007. Elevator lobbies serving evacuation elevators shall be designed to accommodate persons using wheel chairs, along with other elevator users.

2. Revise text as follows:

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 used as an exit in accordance with Section 1023.

1017.1 General. Exits shall comply with Sections 1017 through ~~1022~~ 1023 and the applicable requirements of Sections 1003 through 1012.

3. Add new text as follows:

[F} 2702.20 (IFC 604.2.20) Elevator evacuation system. Emergency power shall be provided for all elevators used within an Elevator Evacuation System in accordance with Section 1023.7.

Reason: The purpose of the proposed change is to allow elevators under certain conditions to be counted as part of the means of egress width.
An elevator evacuation system should be permitted to be use as coordinated life safety program as long as various checks and balances are provided. Elevators work normally prior to phase I recall. If phase I recall occurs that means smoke is in the elevator lobby or shaft. The provisions of this section provide more substantial elevator lobby protection be in place to allow the use of elevators for egress width for longer periods of time.

These redundancies make the protection of the elevator more substantial and increase the likelihood of elevator availability. This section also tries to recognize the needs of the fire service by providing a dedicated elevator for their use. This is especially important if the elevators will continue to run during a fire event. Additional protection is provided for the fire service elevators, and these elevators are required to be located in separate lobbies.

This proposal provides a more universal method of design for evacuation wheelchair users. Section 1007 is geared towards assisted evacuation by emergency responders utilizing elevators. The approach proposed would allow such occupants to self evacuate as soon as an alarm was sounded or displayed.

This code change requires a study of the egress time. The criteria require a review of a full building evacuation. It should be noted that the code does not require buildings to be designed for full building evacuation. This analysis is a method of setting a baseline of performance.

This proposal has drawn from several of the WTC recommendations for the use of elevators during egress.

Cost Impact: The code change proposal is an elective provision and therefore will not increase the cost of construction.

Analysis: The action on the proposed new Section 2702.20 is dependent on the decision of the Means of Egress Committee to the remainder of the proposal, therefore, for consistency, the MEO Committee will make the determination for this section instead of the IFC Committee.

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