CTC Elevator Lobbies

Study Group Report for CTC Meeting June 28-29, 2012

Group A

Public comments are being considered for FS66-12 and FS88-12

FS66 – 12

713.14.1 (New), 713.14.1, 713.14.1.1

Proponent: Carl Baldassarra, P.E., FSFPE, Chair, ICC Code Technology Committee

Add new text as follows:

713.14.1 General. Enclosed elevator lobbies shall be provided in accordance with Section 713.14.2 for hoistways exceeding 420 feet (128 000 mm) in height. The height of the hoistway shall be measured from the top of the lowest finished floor to the top of the highest finished floor of the floors served by the hoistway.

The height of elevator hoistways sharing a common atmosphere by elevator door openings at a common floor or by openings between hoistways shall be measured from the top of the lowest finished floor to the top of the highest finished floor of the floors served by the non separated hoistways.

Exceptions:

1. The height of elevator hoistways sharing a common atmosphere only at a level of exit discharge shall be permitted to be measured separately.
2. The height of elevator hoistways with openings at a common floor shall be permitted to be measured separately where the hoistways are separated by at least 2 sets of doors or a revolving door that maintains a separation of the atmosphere.

713.14.2~~1~~ Elevator lobby requirements. Where an enclosed elevator lobby is required they shall be provided at each ~~floor~~ hoistway entrance ~~where an elevator shaft enclosure connects more than three *stories*~~. The lobby enclosure shall separate the elevator shaft enclosure doors from each floor by *fire partitions*. In addition to the requirements in Section 708 for *fire partitions*, doors protecting openings in the elevator lobby enclosure walls shall also comply with Section 716.5.3 as required for *corridor* walls and penetrations of the elevator lobby enclosure by air ducts and transfer openings hall be protected as required for *corridors* in accordance with Section 717.5.4.1. Elevator lobbies shall have at least one *means of egress* complying with Chapter 10 and other provisions within this code.

Exceptions:

1. Enclosed elevator lobbies are not required at the level(s) of *exit discharge*, provided the level(s) of *exit discharge* is equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

2. Elevators not required to be located in a hoistway ~~shaft~~ in accordance with Section 712 are not required to have enclosed elevator lobbies.

3. Enclosed elevator lobbies are not required where additional doors are provided at the hoistway opening in accordance with Section 3002.6. Such doors shall comply with the smoke and draft control door assembly requirements in Section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal.

~~4. Enclosed elevator lobbies are not required where the building is protected by an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. This exception shall not apply to the following:~~

~~4.1 Group I-2 occupancies;~~

~~4.2 Group I-3 occupancies, and~~

~~4.3 Elevators serving floor levels over 75 feet (22 860 mm) above the lowest level of fire department vehicle access in high-rise buildings.~~

~~5~~4. Smoke partitions shall be permitted in lieu of *fire partitions* to separate the elevator lobby at each floor where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition to the requirements in Section 710 for smoke partitions, doors protecting openings in the smoke partitions shall also comply with Sections 710.5.2.2, 710.5.2.3, and 716.5.9 and duct penetrations of the smoke partitions shall be protected as required for *corridors* in accordance with Section 717.5.4.1.

~~6~~5. Enclosed elevator lobbies are not required where the elevator hoistway is pressurized in accordance with Section 909.21.

~~7~~6. Enclosed elevator lobbies are not required where the elevator serves only *open parking garages* in accordance with Section 406.5.

~~**713.14.1.1 Area of refuge.** Areas of refuge shall be provided as required by Section 1007.~~

Reason: This proposal is one of several proposals submitted by the CTC Elevator lobby SG. The ICC Executive Board directed the Code Technology Committee (CTC) to study the issue of elevator lobby separations in November 2010 due to the number of code change proposals submitted addressing this issue over a number of code change cycles. The Code Technology Committee formed a study group on the elevator lobby separation issue in December 2010. Note that this subject had been previously addressed by CABO/BCMC in 1986 with a similar conclusion. The code change proposals submitted are the result of the CTC's study of the issue. Note that the scope of the activity was as follows:

Scope

- Review the need for elevator lobbies~~,~~: with emphasis on building use, building and hoistway height, active and passive fire protection features associated with the aforementioned.
- Review the differences and specific needs when dealing with elevator lobbies of traditional-use elevators, fire service elevators, and occupant evacuation elevators.
- Review related code provisions, such as egress from and through elevator lobbies.
- Review the appropriate use of alternatives including pressurization of hoistways, additional doors, roll-down style barriers, and gasketing systems.
- Review with members of elevator industry to scope the requirements of applicable elevator reference standards as it deals with elevator lobby design, use and construction.

- Review design and construction requirements for elevator lobbies, including but not limited to dimensions, location and separation.
- Review applicable code change history, technical studies and loss statistics as part of this review.

Based upon the extensive nature of this area of study**,** 5 Task Groups were formed during the process to provide in-depth review and to manage the number of issues. These task groups developed a number of proposals that were coordinated throughout the process.

More information on this CTC area of study can be found at the following link.
http://www.iccsafe.org/cs/CTC/Pages/ElevatorLobbies.aspx

This proposal is a technical shift away from what has been termed by the CTC study group "traditional elevator lobbies" as opposed to Fire Service Access Elevators and Occupant evacuation elevators. This shift is based upon background data and a technical analysis produced by the Study Group on Elevator lobbies for the CTC. An executive summary of the technical analysis is as follows:

EXECUTIVE SUMMARY

The ICC Executive Board directed the Code Technology Committee (CTC) to study the issue of elevator lobby separations in November 2010 due to the number of code change proposals submitted addressing this issue over a number of code change cycles. The Code Technology Committee formed a study group on the elevator lobby separation issue in December 2010. The code change proposals submitted are the result of the CTC's study of the issue.

This focus of the study group began with a review of technical documents and the history of the code provisions over the years. This led to extensive discussions on the intent and need for enclosed elevator lobbies and included calculations to determine the effect of stack effect in high rise buildings. This technical review resulted in a technical analysis that determined when enclosed elevator lobbies should be required.

Enclosed elevator lobbies should not be required for:

- Low-rise and mid-rise buildings not provided with sprinkler protection
- High rise buildings where the elevator hoistway is 420 feet or less in height.

Enclosed elevator lobbies should be required for:

- Elevator hoistways exceeding 420 feet in height
- Fire Service Access Elevators regardless of building height
- Occupant evacuation elevators regardless of building height

The basis for eliminating the requirement for enclosed elevator lobby separations in low-rise and mid-rise buildings (whether or not provided with sprinkler protection) is that these buildings can be evacuated in a relatively short period of time. Hence, any hazard of the spread of smoke via the elevator hoistways in these buildings is mitigated by evacuation of the building occupants.

The basis for eliminating the requirement for enclosed elevator lobby separations in high rise buildings (where the height of the elevator hoistway is 420 feet or less) is the many fire safety features required by the building code, including automatic sprinklers, that mitigate the hazard of the spread of smoke via elevator hoistways. The cooling of the smoke by automatic sprinkler discharge also reduces its buoyancy, the principal driving force which causes migration of smoke between floors. The "stack effect", the

pressure differentials between floors due to differences in indoor and outdoor temperatures, is not significant enough to cause large quantities of smoke from the floor of origin to migrate to other floors in the building.

The decision to require enclosed elevator lobbies in buildings where the elevator hoistway height exceeds 420 feet in height relates to the greater concern with stack effect in such tall shafts and the potential consequences of fires in taller buildings with larger occupant loads further from the level of exit discharge.

One of the concerns that the CTC wrestled with in developing these proposals is the reliability and effectiveness of a building's many fire safety features but most specifically automatic sprinklers. To further address these concerns the technical analysis presents a brief analysis of the various protection features available in high rise buildings and how they work together. This analysis makes it clear that sprinklers are just one of many fire safety features that are part of a holistic protection strategy in high rise buildings.

Based upon the technical analysis the requirements for enclosed elevator lobbies have been shifted to hoistway heights starting beyond 420 feet. The full recommendations are listed below:

Recommendations:

1. Unsprinklered low- and mid-rise buildings (buildings with an occupied floor less than 55 feet above the lowest level of fire department vehicle access or less than 75 feet above the lowest level of fire department access with an occupant load less than 30 on each floor)

- **No enclosed elevator lobbies required for traditional elevators.**

o *Rationale: While fire temperatures can be high, causing smoke and gas migration throughout the building, occupants traveling at the typical rate of about 150 ft/min over the maximum permitted travel distance of 200 ft can reach the safety of an egress stairway in approximately 1.3 minutes and can descend to the level of exit discharge in less than five minutes. This time frame is merely an approximation but provides an indication of the required time necessary for egress in low and mid-rise buildings.*

Additionally, code officials participating in the study group stated that lobbies have traditionally not been required in these type buildings in their jurisdictions and their experience has been good.

Sprinklers are required in any building containing Fire service access (3007) and occupant evacuation (3008) elevators so these would not be found in buildings in this category.

Elevator lobbies serving as an area of refuge in accordance with Section 1007.6 for accessible means of egress are required to be enclosed by smoke barriers

2. Sprinklered buildings with occupied floors less than or equal to 75 feet to the lowest level of fire department vehicle access:

- **No enclosed elevator lobbies required for traditional elevators**

o *Rationale: In sprinklered buildings fire temperatures are kept relatively low so hot gas expansion and buoyancy are not driving forces Traditional elevators are not to be used by occupants in fires, so any small infiltration into the hoistway is not significant. Shafts shorter than 75 feet have limited stack effect flows.*

- **Enclosed lobbies required for fire service access (3007) and occupant evacuation (3008) elevators**

o *Rationale: Fire service access and occupant egress elevators need to continue in operation during a fire. Lobbies provide a protected space to stage and to await the elevator and further provide a physical barrier to smoke that might activate a lobby smoke detector and trigger Phase I recall.*

3. Sprinklered buildings with an occupied floor more than 75 feet to the lowest level of fire department vehicle access and with elevator hoistway heights less than or equal to 420 feet.

- **No enclosed elevator lobbies required for traditional elevators.**

o *Rationale: In sprinklered buildings fire temperatures at the ceiling are kept relatively low so hot gas expansion and buoyancy are not driving forces. Traditional elevators are not to be used by occupants in fires, so any small infiltration into the hoistway is not significant. Shafts shorter than 420 feet have limited stack effect flows.*

- **Enclosed elevator lobbies required for fire service access (3007) and occupant evacuation (3008) elevators**

o *Rationale: Fire service access and occupant egress elevators need to continue in operation during a fire. Lobbies provide a protected space to stage and to await the elevator and further provide a physical barrier to smoke that might activate a lobby smoke detector and trigger Phase I recall.*

4. Sprinklered buildings with hoistway heights more than 420 feet in building height

- **Enclosed elevator lobbies or pressurization of the elevator hoistways required for traditional elevators.**

o *Rationale: While traditional elevators are not permitted to be used in fires, the elevator hoistway height may result in smoke migration due to "stack effect" and spread to remote areas. Enclosed lobbies with smoke tight construction or pressurization of the hoistways will limit infiltration. The consequences of smoke spread in tall buildings with elevator hoistway heights over 420 feet was of greater concern to the Study Group.*

- **EXCEPTION:**

1. Hoistways for traditional elevators separated into vertical sections not exceeding 420 feet in height with no communication of the hoistway environment between sections shall not require enclosed lobbies or pressurization as long as the following condition is met.

2. Where connection of elevator banks is by a transfer corridor, it shall be necessary to pass through at least 2 swinging doors or a revolving door that maintains a separation of the environments to pass from one section to another.

o *Rationale: By separating the hoistways into shorter sections and limiting communication of different shaft environments, both "stack effect" and smoke migration will be limited.*

- **Enclosed elevator lobbies required for fire service access (3007) and occupant evacuation (3008) elevators**

o *Rationale: Fire service access and occupant egress elevators need to continue in operation during a fire. Lobbies provide a protected space to stage and to await the elevator and further provide a physical barrier to smoke that might activate a lobby smoke detector and trigger Phase I recall.*

5. Elevator hoistway pressurization design

- **The design of pressurization systems for elevator hoistways shall be based on a *rational analysis* in accordance with Section 909.4 that utilizes a network model approved by the AHJ and which includes an analysis of possible interactions between building shafts pressurized by different systems, and between pressurized and unpressurized shafts that exceed 420 feet in height.**

Add guidance to commentary for 909.4 that the rational analysis should show that the pressurization design will maintain the estimated Fractional Effective Dose (FED) below 0.5 and the estimated visibility distance above 25 feet within the stairway for 1.5 times the estimated evacuation time for each of the design fires selected.

o *Rationale: Taller buildings with more complex flow paths require analysis utilizing a network model that can account for these interacting flow paths. The criteria suggested for commentary represents the standard of practice for a fire hazard analysis performed as the required rational analysis.*

It is important to note that these recommendations address fire service access elevators as well as occupant evacuation elevators but such elevators are not applicable to Section 713.14. In fact the recommendation of the analysis for those types of elevators was to keep the lobbies as they provide a multitude of functions that differ from traditional elevator lobbies. Additionally it should be noted that although enclosed elevator lobbies have been eliminated in many buildings for "traditional" elevators any building containing occupied floors more than 120 feet from the lowest level of fire department access will be required to have fire service access elevators. Such elevators are required to have a lobby with several integral features. If the elevators of choice are passenger elevators in the building an enclosed elevator lobby would be required of more substantial construction as compared to what is required in Section 713.14.1. This same logic would apply in buildings that allow the use of elevators for evacuation in accordance with Section 3008. In that case lobbies would be required for the entire building regardless of building height.

Since the buildings where elevator lobbies are required by this proposal will be sprinklered and area of refuge would not be required the reference to area of refuge as it relates to elevator lobbies is no longer necessary.

If this proposal passes the other CTC proposals related to elevator lobbies may require some level of renumbering or will no longer be necessary. As this is one of several proposals from the CTC on elevator lobbies a draft assuming all the CTC elevator

lobby related proposals passing is provided to show how they would integrate together. Each proposal in intent are independent with one another. There are some situations that may need approval of the CCC but the following demonstrates the intent of the CTC should all proposals pass.

Chapter 2

(G175-12) **DIRECT ACCESS.** A path of travel from a space to an immediately adjacent space through an opening in the common wall between the two spaces.

Chapter 7

(FS37-12) **709.4 Continuity.** *Smoke barriers* shall form an effective membrane continuous from outside wall to outside wall and from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, deck or slab above, including continuity through concealed spaces, such as those found above suspended ceilings, and interstitial structural and mechanical spaces. The supporting construction shall be protected to afford the required *fire-resistance rating* of the wall or floor supported in buildings of other than Type IIB, IIIB or VB construction.

Exceptions:

1. Smoke-barrier walls are not required in interstitial spaces where such spaces are designed and constructed with ceilings that provide resistance to the passage of fire and smoke equivalent to that provided by the smoke-barrier walls.

2. Smoke barriers used ~~for~~ to enclose elevator lobbies in accordance with Section 405.4.3, 1007.6.2, 300~~7~~8.7.2 or 300~~8~~9.7.2 shall be permitted to terminate at the elevator hoistway shaft enclosure. ~~not required to extend from outside wall to outside wall.~~ A smoke and draft control door assembly as specified in Section 716.5.3.1 shall not be required at each elevator hoistway door opening.

3. Smoke barriers used for areas of refuge in accordance with Section 1007.6.2 are not required to extend from outside wall to outside wall.

(FS88-12) **716.5.3.1 Smoke and draft control.** *Fire door* assemblies shall also meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot (0.01524 $m^3/s \cdot m^2$) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature and elevated temperature tests. Louvers shall be prohibited. Installation of smoke doors shall be in accordance with NFPA 105.

Exception: Where enclosed elevator lobbies are not required by Section 3007.2 ~~713.14.1~~, elevator hoistway doors opening into a corridor are not required to meet the requirements for a smoke and draft control door assembly.

Chapter 10

(E45-12) **1007.6 Areas of refuge.** Every required area of refuge shall be accessible from the space it serves by an accessible means of egress.

1007.6.1 Travel distance. The maximum travel distance from any accessible space to an area of refuge shall not exceed the travel distance permitted for the occupancy in accordance with Section 1016.1.

1007.6.2 Stairway or elevator access. Every required area of refuge shall have direct access to a stairway ~~within an exit enclosure~~ complying with Sections 1007.3 and 1022 or an elevator complying with Section 1007.4.

~~Where an elevator lobby is used as an area of refuge , the shaft and lobby shall comply with Section 1022.9 for smokeproof enclosures except where the elevators are in an area of refuge formed by a horizontal exit or smoke barrier.~~

1007.6.2~~3~~ Separation. Each *area of refuge* shall be separated from the remainder of the story by a *smoke barrier* complying with Section 709 or a *horizontal exit* complying with Section 1025. Each *area of refuge* shall be designed to minimize the intrusion of smoke.

Exception: *Areas of refuge* located within an enclosure for *exit access stairways* or *interior exit stairways* *complying with Section 1009.3 or Section 1022*.

1007.6.~~3~~5 Two-way communication. *Areas of refuge* shall be provided with a two-way communication system complying with Sections 1007.8.1 and 1007.8.2.

(E110-12) **Add a new item 5 to section 1014.2:**

5. Exit access through an enclosed elevator lobby is permitted. Access to at least one of the required exits shall be provided without travel through the enclosed elevator lobbies required by Sections 3007.2 ~~713.14.1~~, 3007~~7~~8 or 3008~~9~~.

Where the path of exit access travel passes through an enclosed elevator lobby the level of protection required for the enclosed elevator lobby is not required to be extended to the exit unless direct access to an exit is required by other sections of this code.

(E110-12) **1018.6 Corridor continuity.** Fire-resistance-rated *corridors* shall be continuous from the point of entry to an *exit*, and shall not be interrupted by intervening rooms. Where the path of egress travel within a fire-resistance-rated *corridor* to the *exit* includes travel along unenclosed *exit access stairways* or *ramps*, the *fire resistance-rating* shall be continuous for the length of the *stairway* or *ramp* and for the length of the connecting *corridor* on the adjacent floor leading to the *exit*.

Exception~~s~~:

1. Foyers, lobbies or reception rooms constructed as required for *corridors* shall not be construed as intervening rooms.

2. Enclosed elevator lobbies as permitted by Section 1014.2 item 5 shall not be construed as intervening rooms.

(E144-12) **1022.10 Elevator Lobby identification signs.** At landings in interior exit stairways where two or more doors lead to the floor level, the door leading to the elevator lobby shall be identified by signage located on the door or directly adjacent to the door stating "Elevator Lobby." Signage shall be in accordance with Section 1022.9.1 items 4, 5 and 6.

(G125-12) **1027.1 General.** *Exits* shall discharge directly to the exterior of the building. The *exit discharge* shall be at grade or shall provide a direct path of egress travel ~~access~~ to grade. The *exit discharge* shall not reenter a building. The combined use of Exceptions 1 and 2 shall not exceed 50 percent of the number and capacity of the required exits.

Chapter 30

(FS61-12, FS66-12, FS67-12, FS70-12, E110-12,)

SECTION 3007

ELEVATOR LOBBIES

3007.1 General. Enclosed elevator lobbies shall be provided in accordance with the following sections.

1. Section 3007.2 based upon hoistway height ~~number of stories connected by a shaft enclosure~~. (*CCC*)
2. Section 405.4.3 for underground buildings.
3. Sections 407.5.3 and 711.9 for Group I-2 occupancies.
4. ~~Section 1007.4 for areas of refuge.~~ (*CCC*)
4. Section 3008.7.2 for fire service access elevators.
5. Section 3009.7.2 for occupant evacuation elevators.

3007.2 ~~713.14.1~~ General. Protection of hoistway door openings ~~Enclosed elevator lobbies~~ (CCC) shall be provided in accordance with Section 3007.3 ~~713.14.2~~ for hoistways exceeding 420 feet (128 000 mm) in height. The height of the hoistway shall be measured from the top of the lowest finished floor to the top of the highest finished floor of the floors served by the hoistway.

The height of elevator hoistways sharing a common atmosphere by elevator door openings at a common floor or by openings between hoistways shall be measured from the top of the lowest finished floor to the top of the highest finished floor of the floors served by the non separated hoistways.

Exceptions:

1. The height of elevator hoistways sharing a common atmosphere only at a level of exit discharge shall be permitted to be measured separately.
2. The height of elevator hoistways with openings at a common floor shall be permitted to be measured separately where the hoistways are separated by at least 2 sets of doors or a revolving door that maintains a separation of the atmosphere.
3. Protection of elevator hoistway door openings is not required where the elevator serves only open parking garages in accordance with Section 406.5.
4. Protection of elevator hoistway door openings is not required at the level(s) of exit discharge, provided the level(s) of exit discharge is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.
5. Elevators not required to be located in a shaft in accordance with Section 712.1 are not required to protect elevator hoistway door openings. (*this is something that needs to be stated here but not in the original TG4 proposal* 2 CCC)
6. Enclosed elevator lobbies and protection of elevator hoistway door openings are not required where the elevator hoistway opens to the exterior.

3007.3 ~~713.14.2~~1 Elevator hoistway door opening protection ~~Lobby~~ requirements. Where Section **3007.2 ~~713.14.1~~** requires protection of the elevator hoistway door opening, one of the following protection options shall be provided .~~Where an enclosed elevator lobby is required they shall be provided~~ at each ~~floor~~ hoistway entrance ~~where an elevator shaft enclosure connects more than three *stories*~~.

1. ~~The~~ A lobby enclosure shall separate the elevator shaft enclosure doors from each floor by *fire partitions*. In addition to the requirements in Section 708 for *fire partitions*, doors protecting openings in the elevator lobby enclosure walls shall also comply with Section 716.5.3 as required for *corridor* walls and penetrations of the elevator lobby enclosure by air ducts and transfer openings hall be protected as required for *corridors* in accordance with Section 717.5.4.1. Elevator lobbies shall have at least one *means of egress* complying with Chapter 10 and other provisions within this code.

   ~~**Exceptions:**~~

   ~~1. Enclosed elevator lobbies are not required at the level(s) of *exit discharge*, provided the level(s) of *exit discharge* is equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1.~~

   ~~2. Elevators not required to be located in a hoistway shaft in accordance with Section 712 are not required to have enclosed elevator lobbies.~~

2. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by smoke partitions in accordance with Section 710 where the building is equipped throughout with an automatic sprinkler system installed in accordance with 903.3.1.1 or 903.3.1.2. In addition, doors protecting openings in the smoke partitions shall comply with Sections 710.5.2.2, 710.5.2.3, and 716.5.9. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1.

3. ~~Enclosed elevator lobbies are not required where~~ An additional door~~s~~ shall be ~~are~~ provided at ~~the~~ each elevator hoistway door opening in accordance with Section 3002.6. Such door shall comply with the smoke and draft control door assembly requirements in Section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal.

~~4. Enclosed elevator lobbies are not required where the building is protected by an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. This exception shall not apply to the following:~~

   ~~4.1 Group I-2 occupancies;~~

   ~~4.2 Group I-3 occupancies, and~~

   ~~4.3 Elevators serving floor levels over 75 feet (22 860 mm) above the lowest level of fire department vehicle access in high-rise buildings.~~

~~5.~~ ~~Smoke partitions shall be permitted in lieu of *fire partitions* to separate the elevator lobby at each floor where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition to the requirements in Section 710 for smoke partitions, doors protecting openings in the smoke partitions shall also comply with Sections 710.5.2.2, 710.5.2.3, and 716.5.9 and duct penetrations of the smoke partitions shall be protected as required for *corridors* in accordance with Section 717.5.4.1.~~

4.~~6.~~ ~~Enclosed Elevator lobbies are not required where the~~ The elevator hoistway ~~is~~ shall be pressurized in accordance with Section 909.21.

~~7.~~ ~~Enclosed elevator lobbies are not required where the elevator serves only *open parking garages* in accordance with Section 406.5.~~

3007.4 ~~713.14.3~~ Means of egress. Enclosed (CCC based on definition) Elevator lobbies shall be provided with at least one means of egress complying with Chapter 10 and other provisions in this code. Egress through an elevator lobby shall be permitted in accordance with Section 1014.2 item 5

~~**713.14.1.1 Area of refuge.** Areas of refuge shall be provided as required by Section 1007.~~

(note 3007 and 3008 would need to be renumbered in entirety)

(E110-12) **3007~~7~~8.7 Fire service access elevator lobby.** The fire service access elevator shall open into a fire service access elevator lobby in accordance with Sections 3007~~7~~8.7.1 through 3007~~7~~8.7.5. Egress is permitted through the elevator lobby in accordance with Section 1014.2 item 5.

Exception: Where a fire service access elevator has two entrances onto a floor, the second entrance shall be permitted to open into an elevator lobby in accordance with Section 708.14.1.

(G175-12) **3007~~7~~8.7.1 Interior exit stairway access.** The fire service access elevator lobby shall have direct access from the enclosed elevator lobby to an enclosure for an interior exit stairway.

Exception: Access to an interior exit stairway shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.5.3.

(G177-12) **3007~~7~~8.7.4 Lobby size.** Regardless of the number of fire service access elevators served by the same elevator lobby, ~~each~~ the enclosed fire service access elevator lobby shall be a minimum of 150 square feet (14 m^2) in an area with a minimum dimension of 8 feet (2440 mm).

(E110-12) **3008~~7~~9.7 Occupant evacuation elevator lobby.** The occupant evacuation elevators shall open into an elevator lobby in accordance with Sections 3008.7.1 through 3008.7.7. Egress is permitted through the elevator lobby in accordance with Section 1014.2 item 5.

(G175-12) **3008~~9~~.7.1 Interior exit stairway access.** The occupant evacuation elevator lobby shall have direct access from the enclosed elevator lobby to an interior exit stairway or ramp.

Exception: Access to an interior exit stairway shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.5.3.

(Note if all proposals pass the following proposals are no longer necessary FS71-12 and FS69-12)

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

FS66-12

Public Hearing:

Committee:	AS	AM	D
Assembly:	ASF	AMF	DF

713.14.1 #1-FS-Baldassarra-CTC

FS66-12

Committee Action: Disapproved

Committee Reason: The committee disapproved this change for several reasons as follows: The proposal should not be applicable to unsprinklered buildings; the proposal should be limited to only certain Groups, such as Group B; lobby protection should not be eliminated as this puts too much reliance on the fire suppression system; and Groups I-2 and I-3 are similar in that occupants are not leaving the building in an emergency and therefore should afforded the same protection (lobbies).

Assembly Action: None

FS66-12 (possible public comment)

Approved As Modified

Modify proposal as follows:

713.14.1 General. Enclosed elevator lobbies shall be provided in accordance with Section 713.14.2 for hoistways exceeding 420 feet (128 000 mm) in height and where an elevator hoistway connects more

than three *stories* in buildings not protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. The height of the hoistway shall be measured from the top of the lowest finished floor to the top of the highest finished floor of the floors served by the hoistway.

The height of elevator hoistways sharing a common atmosphere by elevator door openings at a common floor or by openings between hoistways shall be measured from the top of the lowest finished floor to the top of the highest finished floor of the floors served by the non separated hoistways.

Exceptions:

1. The height of elevator hoistways sharing a common atmosphere only at a level of exit discharge shall be permitted to be measured separately.
2. The height of elevator hoistways with openings at a common floor shall be permitted to be measured separately where the hoistways are separated by at least 2 sets of doors or a revolving door that maintains a separation of the atmosphere.

713.14.2 Elevator lobby requirements. Where an enclosed elevator lobby is required they shall be provided at each hoistway entrance. The lobby enclosure shall separate the elevator shaft enclosure doors from each floor by *fire partitions*. In addition to the requirements in Section 708 for *fire partitions*, doors protecting openings in the elevator lobby enclosure walls shall also comply with Section 716.5.3 as required for *corridor* walls and penetrations of the elevator lobby enclosure by air ducts and transfer openings hall be protected as required for *corridors* in accordance with Section 717.5.4.1. Elevator lobbies shall have at least one *means of egress* complying with Chapter 10 and other provisions within this code.

Exceptions:

1. Enclosed elevator lobbies are not required at the level(s) of *exit discharge*, provided the level(s) of *exit discharge* is equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

2. Elevators not required to be located in a hoistway in accordance with Section 712 are not required to have enclosed elevator lobbies.

3. Enclosed elevator lobbies are not required where additional doors are provided at the hoistway opening in accordance with Section 3002.6. Such doors shall comply with the smoke and draft control door assembly requirements in Section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal.

4. Smoke partitions shall be permitted in lieu of *fire partitions* to separate the elevator lobby at each floor where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition to the requirements in Section 710 for smoke partitions, doors protecting openings in the smoke partitions shall also comply with Sections 710.5.2.2, 710.5.2.3, and 716.5.9 and duct penetrations of the smoke partitions shall be protected as required for *corridors* in accordance with Section 717.5.4.1.

5. Enclosed elevator lobbies are not required where the elevator hoistway is pressurized in accordance with Section 909.21.

6. Enclosed elevator lobbies are not required where the elevator serves only *open parking garages* in accordance with Section 406.5.

Reason: One of the major concerns with this proposal seemed to be the mid rise buildings that were not required to be sprinklered. This public comment will now address those buildings by requiring any building not protected throughout with an NFPA 13 system and having hoistways connecting more than three stories to have elevator lobbies.

In terms of the application of the rest of the proposal the CTC still feels that the justification provided in the technical report supports the elimination of elevator lobbies in most buildings. For reference and review the Tehnical report is provided below. [placed at end of this report but will place together for the public comment].

FS88 – 12

716.5.3.1

Proponent: Carl Baldassarra, P.E., FSFPE, Chair, ICC Code Technology Committee

Revise as follows:

716.5.3.1 Smoke and draft control. *Fire door* assemblies shall also meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot (0.01524 $m^3/s \cdot m^2$) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature and elevated temperature tests. Louvers shall be prohibited. Installation of smoke doors shall be in accordance with NFPA 105.

Exception: Where enclosed elevator lobbies are not required by Section 713.14.1, elevator hoistway doors opening into a corridor are not required to meet the requirements for a smoke and draft control door assembly.

Reason: The ICC Executive Board directed the Code Technology Committee (CTC) to study the issue of elevator lobby separations in November 2010 due to the number of code change proposals submitted addressing this issue over a number of code change cycles. The Code Technology Committee formed a study group on the elevator lobby separation issue in December 2010. Note that this subject had been previously addressed by CABO/BCMC in 1986 with a similar conclusion. The code change proposals submitted are the result of the CTC's study of the issue. Note that the scope of the activity was as follows:

Scope

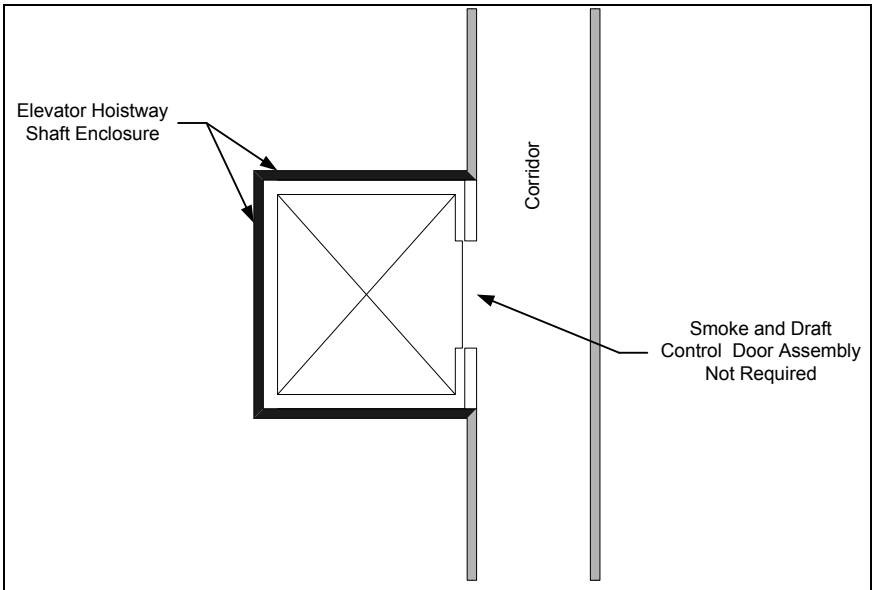
- Review the need for elevator lobbies, with emphasis on building use, building and hoistway height, active and passive fire protection features associated with the aforementioned.
- Review the differences and specific needs when dealing with elevator lobbies of traditional-use elevators, fire service elevators, and occupant evacuation elevators.
- Review related code provisions, such as egress from and through elevator lobbies.
- Review the appropriate use of alternatives including pressurization of hoistways, additional doors, roll-down style barriers, and gasketing systems.
- Review with members of elevator industry to scope the requirements of applicable elevator reference standards as it deals with elevator lobby design, use and construction.
- Review design and construction requirements for elevator lobbies, including but not limited to dimensions, location and separation.
- Review applicable code change history, technical studies and loss statistics as part of this review.

Based upon the extensive nature of this area of study**,** 5 Task Groups were formed during the process to provide in-depth review and to manage the number of issues. These task groups developed a number of proposals that were coordinated throughout the process.

More information on this CTC area of study can be found at the following link.
http://www.iccsafe.org/cs/CTC/Pages/ElevatorLobbies.aspx

This proposal is intended to clarify that when an enclosed elevator lobby is not required in accordance with Section 713.14.1 that smoke and draft protection is not required when the hoistway opens into a rated corridor. See figure below. Section 713.14.1 is based upon number of stories and not the fact that such elevators open onto a rated corridor so it is not entirely clear how the code is currently written that this was the intent . The following are the sections that are relevant to this issue and which demonstrate how such confusion could occur. The lobby provisions are independent from the corridor provisions.

Note that this proposal is one of several proposals submitted by the CTC Elevator Lobby study group. This particular proposal will be correlated as necessary. For instance if the elevator lobby provisions are moved to chapter 30 then the referenced section will be appropriately revised. See discussion on CTC elevator lobby proposal coordination in code change FS##-12



SECTION 716.5.3.1, EXCEPTION – SMOKE AND DRAFT CONTROL AT HOISTWAY

713.14 Elevator, dumbwaiter and other hoistways. Elevator, dumbwaiter and other hoistway enclosures shall be constructed in accordance with Section 713 and Chapter 30.

713.14.1 Elevator lobby. An enclosed elevator lobby shall be provided at each floor where an elevator shaft enclosure connects more than three *stories*. The lobby enclosure shall separate the elevator shaft enclosure doors from each floor by *fire partitions*. In addition to the requirements in Section 708 for *fire partitions*, doors protecting openings in the elevator lobby enclosure walls shall also comply with Section 716.5.3 as required for *corridor* walls and penetrations of the elevator lobby enclosure by ducts and air transfer openings shall be protected as required for *corridors* in accordance with Section 717.5.4.1. Elevator lobbies shall have at least one *means of egress* complying with Chapter 10 and other provisions within this code.

Exceptions:

1. Enclosed elevator lobbies are not required at the level(s) of *exit discharge*, provided the level(s) of *exit discharge* is equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

2. Elevators not required to be located in a shaft in accordance with Section 712.1 are not required to have enclosed elevator lobbies.

3. Enclosed elevator lobbies are not required where additional doors are provided at the hoistway opening in accordance with Section 3002.6. Such doors shall comply with the smoke and draft control door assembly requirements in Section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal.

4. Enclosed elevator lobbies are not required where the building is protected by an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. This exception shall not apply to the following:

   4.1. Group I-2 occupancies;

   4.2. Group I-3 occupancies; and

   4.3. Elevators serving floor levels over 75 feet above the lowest level of fire department vehicle access in high-rise buildings.

5. Smoke partitions shall be permitted in lieu of *fire partitions* to separate the elevator lobby at each floor where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition to the requirements in Section 710 for smoke partitions, doors protecting openings in the smoke partitions shall also comply with Sections 710.5.2.2, 710.5.2.3, and 716.5.9 and duct penetrations of the smoke partitions shall be protected as required for *corridors* in accordance with Section 717.5.4.1.

6. Enclosed elevator lobbies are not required where the elevator hoistway is pressurized in accordance with Section 909.21.

7. Enclosed elevator lobbies are not required where the elevator serves only *open parking garages* in accordance with Section 406.3.

713.14.1.1 Areas of refuge. Areas of refuge shall be provided as required in Section 1007.

SECTION 1018 CORRIDORS

1018.1 Construction. *Corridors* shall be fire-resistance rated in accordance with Table 1018.1. The *corridor* walls required to be fire-resistance rated shall comply with Section 709 for *fire partitions*.

Exceptions:

1. A *fire-resistance rating* is not required for *corridors* in an occupancy in Group E where each room that is used for instruction has at least one door opening directly to the exterior and rooms for assembly purposes have at least one-half of the required *means of egress* doors opening directly to the exterior. Exterior doors specified in this exception are required to be at ground level.

2. A *fire-resistance rating* is not required for *corridors* contained within a dwelling or sleeping unit in an occupancy in Group R.

3. A *fire-resistance rating* is not required for *corridors* in *open parking garages*.

4. A *fire-resistance rating* is not required for *corridors* in an occupancy in Group B which is a space requiring only a single *means of egress* complying with Section 1015.1.

5. Corridors adjacent to the exterior walls of buildings shall be permitted to have unprotected openings on unrated exterior wall where unrated walls are permitted by Table 602 and unprotected openings are permitted by Table 705.8.

SECTION 708 FIRE PARTITIONS

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

1. Walls separating *dwelling units* in the same building as required by Section 420.2.

2. Walls separating *sleeping units* in the same building as required by Section 420.2.

3. Walls separating tenant spaces in *covered mall buildings* as required by Section 402.7.2.

4. Corridor walls as required by Section 1018.1.

5. Elevator lobby separation as required by Section 713.14.1.

708.2 Materials. The walls shall be of materials permitted by the building type of construction.

708.3 Fire-resistance rating. Fire partitions shall have a *fire-resistance rating* of not less than 1 hour.

Exceptions:

1. Corridor walls permitted to have a $^1/_2$ hour *fire-resistance rating* by Table 1018.1.

2. *Dwelling unit* and *sleeping unit* separations in buildings of Type IIB, IIIB and VB construction shall have *fire-resistance ratings* of not less than $^1/_2$ hour in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

708.6 Openings. Openings in a *fire partition* shall be protected in accordance with Section 716.

SECTION 710 SMOKE PARTITIONS

710.1 General. Smoke partitions installed as required elsewhere in the code shall comply with this section.

710.5 Openings. Openings in smoke partitions shall comply with Sections 710.5.1 and 710.5.2.

710.5.1 Windows. Windows in smoke partitions shall be sealed to resist the free passage of smoke or be automatic-closing upon detection of smoke.

710.5.2 Doors. Doors in smoke partitions shall comply with Sections 710.5.2.1 through 710.5.2.3.

710.5.2.1 Louvers. Doors in smoke partitions shall not include louvers.

710.5.2.2 Smoke and draft control doors. Where required elsewhere in the code, doors in smoke partitions shall meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot (0.015424 $m^3/(s \cdot m^2)$) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature test and the elevated temperature exposure test. Installation of smoke doors shall be in accordance with NFPA 105.

SECTION 716 OPENING PROTECTIVES

716.1 General. Opening protectives required by other sections of this code shall comply with the provisions of this section.

716.5 Fire door and shutter assemblies. Approved *fire door* and fire shutter assemblies shall be constructed of any material or assembly of component materials that conforms to the test requirements of Section 716.5.1, 716.5.2 or 716.5.3 and the *fire protection rating* indicated in Table 716.5. *Fire door* frames with transom lights, sidelights or both shall be permitted in accordance with Section 716.5.6. *Fire door* assemblies and shutters shall be installed in accordance with the provisions of this section and NFPA 80.

Exceptions:

1. Labeled protective assemblies that conform to the requirements of this section or UL 10A, UL 14B and UL 14C for tin-clad *fire door* assemblies.

2. Floor *fire door* assemblies in accordance with Section 711.8.

TABLE 716.5

OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE	FIRE RATED GLAZING MARKING DOOR VISION PANEL [e]	MINIMUM SIDELIGHT/ TRANSOM ASSEMBLY RATING (hours)	FIRE RATED GLAZING MARKING SIDELITE/ TRANSOM PANEL
Fire partitions: Corridor walls	0.5	1/3[b]	Maximum size tested	D-20	1/3	D-H- OH-20

716.5.3 Door assemblies in corridors and smoke barriers. *Fire door* assemblies required to have a minimum *fire protection rating* of 20 minutes where located in *corridor* walls or *smoke barrier* walls having a *fire-resistance rating* in accordance with Table 716.5 shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test.

Exceptions:

1. Viewports that require a hole not larger than 1 inch (25 mm) in diameter through the door, have at least a 0.25-inch-thick (6.4 mm) glass disc and the holder is of metal that will not melt out where subject to temperatures of 1,700°F (927°C).

2. *Corridor* door assemblies in occupancies of Group I-2 shall be in accordance with Section 407.3.1.

3. Unprotected openings shall be permitted for *corridors* in multitheater complexes where each motion picture auditorium has at least one-half of its required *exit* or *exit access doorways* opening directly to the exterior or into an *exit* passageway.

4. Horizontal sliding doors in *smoke barriers* that comply with Sections 408.3 and 408.8.4 in occupancies in Group I-3.

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

FS88-12

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

FS88-12

Committee Action: **Disapproved**

Committee Reason: The committee felt that the protection of smoke and draft control doors should be provided on elevator hoistway doors when they open into a corridor that is required to have draft and smoke control doors.

Assembly Action: None

FS88-12 - Possible public comment

Potentially add as one of the current critieria as to when elevator lobbies are required to Section 713.14.1.

Group B Proposals

Fxx-12/13

909.4, 909.4.1(new)

Proponent: Carl Baldassarra, P.E., FSFPE, Chair, ICC Code Technology Committee

909.4 Analysis. A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted *construction documents* and shall include, but not be limited to, the items indicated in Sections 909.4.1 through ~~909.4.6~~ 909.4.6.7. [F]

909.4.1 Stack effect. The system shall be designed such that the maximum probable normal or reverse stack effect will not adversely interfere with the system's capabilities. In determining the maximum probable stack effect, altitude, elevation, weather history and interior temperatures shall be used. [F]

909.4.2 Temperature effect of fire. Buoyancy and expansion caused by the design fire in accordance with Section 909.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with the system's capabilities. [F]

909.4.3 Wind effect. The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of Chapter 16. [F]

909.4.4 HVAC systems. The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems status. The design shall consider the effects of the fire on the HVAC systems. [F]

909.4.5 Climate. The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage. [F]

909.4.6 Duration of operation. All portions of active or passive smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is ~~less~~ greater.

909.4.7 Smoke control system interaction. The design shall consider the interaction effects of the operation of multiple smoke control systems. The analysis shall include all permutations of systems status.

Reason: This proposal is one of several proposals submitted by the CTC Elevator lobby SG. The ICC Executive Board directed the Code Technology Committee (CTC) to study the issue of elevator lobby separations in November 2010 due to the number of code change proposals submitted addressing this issue over a number of code change cycles. The Code Technology Committee formed a study group on the elevator lobby separation issue in December 2010. Note that this subject had been previously addressed by CABO/BCMC in 1986 with a similar conclusion. The code change proposals submitted are the result of the CTC's study of the issue. Note that the scope of the activity was as follows:

Scope

- Review the need for elevator lobbies~~,~~; with emphasis on building use, building and hoistway height, active and passive fire protection features associated with the aforementioned.
- Review the differences and specific needs when dealing with elevator lobbies of traditional-use elevators, fire service elevators, and occupant evacuation elevators.
- Review related code provisions, such as egress from and through elevator lobbies.
- Review the appropriate use of alternatives including pressurization of hoistways, additional doors, roll-down style barriers, and gasketing systems.
- Review with members of elevator industry to scope the requirements of applicable elevator reference standards as it deals with elevator lobby design, use and construction.
- Review design and construction requirements for elevator lobbies, including but not limited to dimensions, location and separation.
- Review applicable code change history, technical studies and loss statistics as part of this review.

Based upon the extensive nature of this area of study**,** 5 Task Groups were formed during the process to provide in-depth review and to manage the number of issues. These task groups developed a number of proposals that were coordinated throughout the process.

More information on this CTC area of study can be found at the following link.
http://www.iccsafe.org/cs/CTC/Pages/ElevatorLobbies.aspx

The CTC studied the need for elevator lobbies for traditional elevators (Section 713.14.1), FSAE (3007) and Occupant Evacuation elevators (3008). The Study Group assigned by the CTC conducted a technical analysis that concluded with several recommendations for the need for such lobbies and in addition provided a recommendation on the need for a closer analysis of buildings with more complexities. The executive summary of this analysis is as follows:

EXECUTIVE SUMMARY

The ICC Executive Board directed the Code Technology Committee (CTC) to study the issue of elevator lobby separations in November 2010 due to the number of code change proposals submitted addressing this issue over a number of code change cycles. The Code Technology Committee formed a study group on the elevator lobby separation issue in December 2010. The code change proposals submitted are the result of the CTC's study of the issue.

This focus of the study group began with a review of technical documents and the history of the code provisions over the years. This led to extensive discussions on the intent and need for enclosed elevator lobbies and included calculations to determine the effect of stack effect in high rise buildings. This technical review resulted in a technical analysis that determined when enclosed elevator lobbies should be required.

Enclosed elevator lobbies should not be required for:

- Low-rise and mid-rise buildings not provided with sprinkler protection
- High rise buildings where the elevator hoistway is 420 feet or less in height.

Enclosed elevator lobbies should be required for:

- Elevator hoistways exceeding 420 feet in height
- Fire Service Access Elevators regardless of building height
- Occupant evacuation elevators regardless of building height

The basis for eliminating the requirement for enclosed elevator lobby separations in low-rise and mid-rise buildings (whether or not provided with sprinkler protection) is that these buildings can be evacuated in a relatively short period of time. Hence, any hazard of the spread of smoke via the elevator hoistways in these buildings is mitigated by evacuation of the building occupants.

The basis for eliminating the requirement for enclosed elevator lobby separations in high rise buildings (where the height of the elevator hoistway is 420 feet or less) is the many fire safety features required by the building code, including automatic sprinklers, that mitigate the hazard of the spread of smoke via elevator hoistways. The cooling of the smoke by automatic sprinkler discharge also reduces its buoyancy, the principal driving force which causes migration of smoke between floors. The "stack effect", the pressure differentials between floors due to differences in indoor and outdoor temperatures, is not significant enough to cause large quantities of smoke from the floor of origin to migrate to other floors in the building.

The decision to require enclosed elevator lobbies in buildings where the elevator hoistway height exceeds 420 feet in height relates to the greater concern with stack effect in such tall shafts and the potential consequences of fires in taller buildings with larger occupant loads further from the level of exit discharge.

One of the concerns that the CTC wrestled with in developing these proposals is the reliability and effectiveness of a building's many fire safety features but most specifically automatic sprinklers. To further address these concerns the technical analysis presents a brief analysis of the various protection features available in high rise buildings and how they work together. This analysis makes it clear that sprinklers are just one of many fire safety features that are part of a holistic protection strategy in high rise buildings.

In fact in many cases a traditional enclosed elevator lobby was determined to be unnecessary but for unusual building configurations there was more of a concern for interaction of systems and the negative impact of stack effect based upon the findings of the analysis. For instance, highrise buildings may contain an atrium and will also use stair pressurization. In some cases hoistway pressurization could also be used as an option for compliance with the enclosed elevator lobby requirements. These are three smoke control systems that when running simultaneously may not work as intended. Below is recommendation 5 from the technical analysis.

5. Elevator hoistway pressurization design

- **The design of pressurization systems for elevator hoistways shall be based on a *rational analysis* in accordance with Section 909.4 that utilizes a network model approved by the AHJ and which includes an analysis of possible interactions between building shafts pressurized by different systems, and between pressurized and unpressurized shafts that exceed 420 feet in height.**

  Add guidance to commentary for 909.4 that the rational analysis should show that the pressurization design will maintain the estimated Fractional Effective Dose (FED) below 0.5 and the estimated visibility distance above 25 feet within the stairway for 1.5 times the estimated evacuation time for each of the design fires selected.

  - *Rationale: Taller buildings with more complex flow paths require analysis utilizing a network model that can account for these interacting flow paths. The criteria suggested for commentary represents the standard of practice for a fire hazard analysis performed as the required rational analysis.*

The focus of this proposal is related to the interaction of multiple mechanical smoke control systems by asking for a specific analysis of the interaction of such systems similar to that required for the interaction of HVAC systems. The study of hoistway pressurization as an option for compliance with enclosed elevator lobby provisions drives the need to understand these interactions as stair pressurization will almost always be present in these buildings as well.

There is also a concern that the current duration requirements are inappropriate for many buildings and should be revised to be a minimum of at least 20 minutes. This will also address buildings that are more complex that will require a much higher duration.

This particular proposal will not affect any of the other Elevator Lobby SG proposals. See discussion on CTC elevator lobby proposal coordination in code change FS##-12

CTC SG Elevator Lobbies – Beth Tubbs

Technical Analysis of the Need for Enclosed Elevator Lobbies

Prepared for the ICC CTC by the Elevator Lobby Study Group

EXECUTIVE SUMMARY

The ICC Executive Board directed the Code Technology Committee (CTC) to study the issue of elevator lobby separations in November 2010 due to the number of code change proposals submitted addressing this issue over a number of code change cycles. The Code Technology Committee formed a study group on the elevator lobby separation issue in December 2010. The code change proposals submitted are the result of the CTC's study of the issue.

This focus of the study group began with a review of technical documents and the history of the code provisions over the years. This led to extensive discussions on the intent and need for enclosed elevator lobbies and included calculations to determine the effect of stack effect in high rise buildings. This technical review resulted in a technical analysis that determined when enclosed elevator lobbies should be required.

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Enclosed elevator lobbies should be required for:

- Elevator hoistways exceeding 420 feet in height
- Fire Service Access Elevators regardless of building height
- Occupant evacuation elevators regardless of building height

The basis for eliminating the requirement for enclosed elevator lobby separations in low-rise and mid-rise buildings (whether or not provided with sprinkler protection) is that these buildings can be

evacuated in a relatively short period of time. Hence, any hazard of the spread of smoke via the elevator hoistways in these buildings is mitigated by evacuation of the building occupants.

The basis for eliminating the requirement for enclosed elevator lobby separations in high rise buildings (where the height of the elevator hoistway is 420 feet or less) is the many fire safety features required by the building code, including automatic sprinklers, that mitigate the hazard of the spread of smoke via elevator hoistways. The cooling of the smoke by automatic sprinkler discharge also reduces its buoyancy, the principal driving force which causes migration of smoke between floors. The "stack effect", the pressure differentials between floors due to differences in indoor and outdoor temperatures, is not significant enough to cause large quantities of smoke from the floor of origin to migrate to other floors in the building.

The decision to require enclosed elevator lobbies in buildings where the elevator hoistway height exceeds 420 feet in height relates to the greater concern with stack effect in such tall shafts and the potential consequences of fires in taller buildings with larger occupant loads further from the level of exit discharge.

One of the concerns that the CTC wrestled with in developing these proposals is the reliability and effectiveness of a building's many fire safety features but most specifically automatic sprinklers. To further address these concerns the technical analysis presents a brief analysis of the various protection features available in high rise buildings and how they work together. This analysis makes it clear that sprinklers are just one of many fire safety features that are part of a holistic protection strategy in high rise buildings.

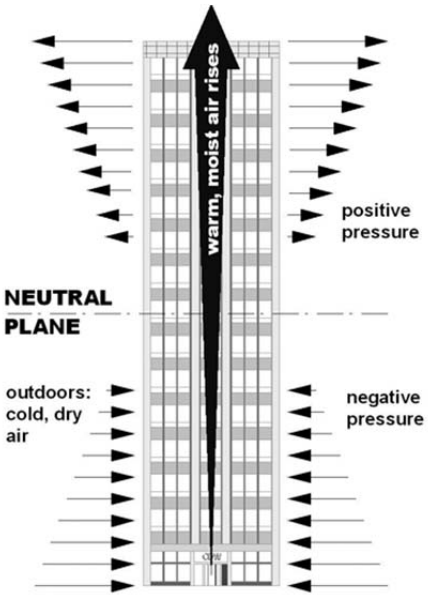
TECHNICAL ANALYSIS

Background

One of the fundamental objectives of fire safety in buildings is to limit the spread of fire and its effects (heat, smoke, and toxic gasses). This is usually accomplished by limiting the ignitability and burning rate of materials, by physical barriers (compartmentation) and by suppression (automatic and/or manual). In specific areas where it is most critical to prevent direct exposure of building occupants that might injure or interfere with evacuation, physical barriers may be supplemented by active or passive smoke control.

The driving force that causes the migration of smoke through a building is differences in temperature (and resulting differences in density) resulting from the fire and from the fact that the environment in many buildings is heated or cooled for comfort. Air flows resulting from these temperature differences increase with increasing difference in temperature and in relation to the area of openings (including visible and hidden gaps and cracks) between spaces at different temperature. It is assumed that smoke flows in a similar manner as air flows inside a building.

One of the early lessons learned from fire disasters is the need to protect shafts that can act as "chimneys," carrying heat, smoke, and gasses to remote areas of a building. Smoke and fire spread up hoistways and stairways accessed through non-rated doors had been implicated as early as in 1911 in the 146 fatalities at the Triangle Shirtwaist Fire [Sunderland 2011]. Other significant fires that involved smoke and fire spread up stairways and hoistways include the Equitable Building Fire, New York, NY, January 9, 1912; and the MGM Grand Hotel, Las Vegas, NV, November 21, 1980.



It should be noted that these were all unsprinklered or partially sprinklered, and the fire started in an unsprinklered area.

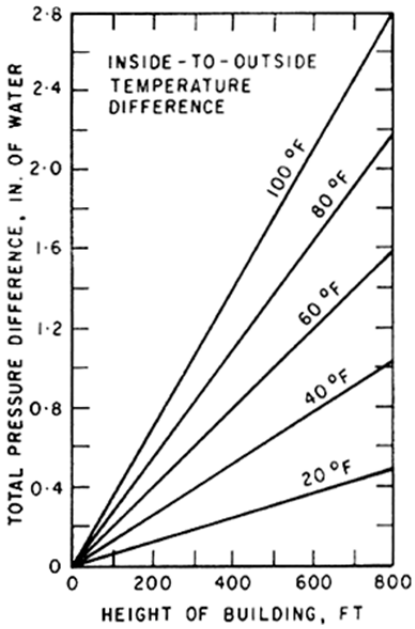
Stack Effect

Stack effect is defined as air flow in shafts induced by indoor-to-outdoor temperature differences that lead to density differences and flow. By convention, stack effect flows are upwards when outdoor temperatures are colder than indoors, and reverse stack effect is a downward flow observed when outdoor temperatures are warmer than indoors. The upward flow results when air from lower floors is drawn into the shaft and flows out on upper floors. Thus, there exists a height in the building at which there is no flow into or out of the shaft, which is called the "neutral plane." Flow rates increase with height above and below the neutral plane. This is illustrated for normal (upward) stack effect in Figure 1.

Figure 1 – Stack Effect Flows

Stack effect flows can be induced in any shaft in a building, including mechanical, plumbing, and electrical shafts. Stack effect creates the greatest problems in elevator hoistways because the hoistways cannot be closed at intervals as can plumbing and electrical shafts, and the landing doors at every floor at which the elevator stops are leaky because they open laterally, making them difficult to seal. Problems associated with stack effect range from annoying (strong flows blowing from openings) to safety hazards when stack effect moves smoke and gasses from fires or accidental chemical releases vertically within the building.

The pressure induced at each floor is a function of the leakage areas, the height of the shaft and the temperature difference. Stack effect pressures across elevator landing doors can range up to 3 in. water (800pa) in an 800 ft building, as shown in Figure 2. [Tamura, G., 1968] Worst case pressures are observed in winter conditions since the indoor to outdoor temperature differences are greatest.



Because elevator landing doors open laterally, excessive pressure across the door can cause the door to bind and not open or close properly. If a landing door doesn't open, people cannot get on/off and if the door doesn't close fully, the elevator cannot leave the floor. Representatives from the elevator industry have indicated that in some buildings that experience significant stack effect, elevator mechanics must come to the building to adjust landing doors at least twice a year.

Figure 2 – Pressures Produced by Stack Effect Across Landing Doors

In fires, the fire itself can result in shaft flows driven by large temperature differences between fire gasses and ambient air. A paper by Bukowski [Bukowski 2005] based on an analysis by Klote showed that, in a fully sprinklered building (with operational sprinklers), fire temperatures are held low enough that significant shaft flows are never observed and the generation of smoke/toxic gasses that might present a hazard to occupants is limited because of the greatly reduced burning rates. Since stack effect is present whether there is a fire or not, shaft flows during fires still occur, but there is much less smoke/toxic gases if there are operating sprinklers.

Enclosed Elevator Lobbies

Enclosed elevator lobbies are intended to address one or more of the following issues:

1. Protecting hoistways as vertical openings that could spread smoke/toxic gasses

For this to be an issue, one needs to have smoke present in sufficient quantities to be hazardous, and pressure differences to drive it to and up or down the hoistway. Smoke is only present in a fire. Pressure differences that drive flows can come from fire temperatures, stack effect, mechanical systems, or elevator piston effect. Sprinklers maintain fire temperatures at only a slightly elevated level, so there is no significant driving force. Fires in sprinklered buildings produce relatively small quantities of smoke/toxic gasses. [Klote 2004; Klote 1992; **NIST** 2010; **NISTIR 7120,** 2004; **NBSIR 80-2097,** 1980.]

Stack effect derives from building (shaft) height, leakage areas between the shaft and the inside/outside, and indoor/outdoor temperature differences. Elevator piston effect is not significant in other than single-car hoistways [Klote and Tamura 1986, Klote 1988].

Absent a fire, stack effect flows can be a nuisance but are rarely a health or safety hazard. In a fire, it is possible for stack effect forces to carry smoke up or down shafts where elevator hoistways would see the largest flows because landing doors have the largest leakage areas. However, the quantity of smoke and gas produced in a sprinkler-controlled fire is small and when distributed into the building volume the concentration, and thus the potential effect on occupants, is small. Further, in a sprinkler-controlled fire, temperatures are held only slightly above ambient, so the only force available to move smoke and gas up shafts is stack effect, and stack effect flows are low.

Using the accepted equation from the 2009 ASHRAE Fundamentals Handbook, estimates of volumetric flows due to stack effect in a 500 ft (152 m) tall hoistway range from just over 1000 CFM to just over 4000 CFM within a range of outdoor temperatures between -40 and +40 F (-40 to +4.4 C). Nuisance problems associated with stack effect are being addressed by designers of very tall buildings by interrupting the shaft height about every 40 stories, but this is not possible on elevators (especially shuttle and service cars) that need to serve every floor. A secondary effect of addressing the nuisance problems is that many shafts are no longer tall enough to yield significant stack effect.

From these facts it can be concluded that elevator lobbies are not generally necessary to prevent smoke migration via hoistways in fires for sprinklered buildings except possibly in very tall buildings with large occupant loads that would require significant time to evacuate from those very tall buildings.

2. Protecting occupants during a fire (safe place)

Since elevators are not to be used in fires except those designated explicitly for Fire Service [IBC Section 3007] and Occupant Egress [IBC Section 3008] and both these sections require lobbies, then lobbies for general use elevators should not be needed to protect occupants during a fire. Exit stairwells are provided explicitly to provide a protected means of egress in fires. One conclusion in the refuge area study for GSA [Klote 1992] was that, in a fully sprinklered building, the entire building is an area of refuge. With respect to protecting occupants in elevators, ASME A17.1 anticipates Firefighter Emergency Operation (FEO) will take the elevators out of service and return them to the level of exit discharge before smoke can enter the hoistway, regardless of whether an enclosed lobby is provided. In Sections 3007 and 3008, the required lobbies are provided to delay recall as long as possible to permit safe use, along with providing a protected space for occupants to wait or for fire fighters to stage below the fire and to operate a forward command post.

Hoistway Pressurization Instead Of Enclosed Elevator Lobbies

Enclosed elevator lobbies are permitted to be eliminated where additional doors [Section 3002.6] or pressurized hoistways [Section 708.14.2] are provided. Pressures are required by the IBC to be between 0.10 and 0.25 in. of water, with the lower limit representing the minimum necessary to prevent flow into the hoistway and the upper limit representing the value above which the landing doors might jam.

In the course of this study, the Study Group discovered that common practice for mechanical designers is to utilize unconditioned outside air to pressurize the hoistway and to pressurize stairways. Filling shafts with air near the outside temperature reduces stack effect since these flows are driven by differences in temperature between the shaft air and outside air.

However, a question has been raised as to the effect of outside air of extreme temperatures (extreme hot or extreme cold) on the safe operation of the elevators, particularly "machine-room-less" elevators, where elevator machinery is located within the hoistway. Typically, elevator manufacturers publish temperature limits in their operating instructions; 95 F (35 C) non-condensing is a common limit. More study may be required to determine how long the equipment can be exposed to extreme temperatures before performance is degraded below safe levels.

The IBC smoke control provisions state that such systems must perform for 20 minutes or 1.5 times the evacuation time, whichever is less. While 1.5 times the evacuation time is reasonable, the 20 minute maximum may not be appropriate for very tall buildings as the time to egress even with elevators may be much longer (depending on the number of floors evacuating or relocating). Occupant self-evacuation elevator systems utilizing all public-use cars (as required in Section 3008 of the IBC) are capable of evacuating 100% of the occupants of any building in 1 hour or less [Bukowski 2008]. Also, the 20 minute maximum would certainly not be appropriate for Fire Service Access Elevators which are intended to be operational for the duration of a fire, not just during building evacuation. Standby power is required to be available for both types of elevators for two hours which may indicate the intended duration of operation.

Smoke Control Systems Design

In any building, there exist complex flow paths that include construction cracks and hidden spaces not normally apparent. The larger the building, the more complex these flow paths can become. In addition, there can be strong interaction between stair and hoistway pressurization systems in buildings that have both [Miller 2008].

Section 909.4 of the IBC requires a *rational analysis* to be performed and submitted with the construction documents, accounting for a number of factors including stack effect, fire temperatures,

wind, HVAC, climate and duration of operation. The scope of the required analysis for many buildings results in a complexity that can only adequately be addressed through the utilization of computer (network) models such as CONTAM, developed and distributed by NIST [NIST 2011, Black and Price 2009, Emmerich, 2001].

Due to the existence of multiple, complex flow paths, all of which interact in complex ways, and especially where some are mechanically pressurized, it is crucial that the required rational analysis utilize network models for high-rise buildings that have one or more of the following characteristics:

- Buildings in which there is more than a 40% difference in floor area between any two floors due to the potential impact of conflicting airflows in the building,
- Buildings that contain a parking garage, whether open or enclosed due to large openings to the outside and introducing large amount of outside air and wind,
- Buildings that contain pressurized stairways, pressurized hoistways, atria (in some cases stacked atria) with mechanical smoke control due to the impact of conflicting airflows and pressure differences in the building.
- Buildings containing shafts taller than 420 feet due to increased stack effect.

Stairway Pressurization

Stairway pressurization generally is outside the scope of this Study Group, but there are many elements of stairway pressurization systems that impact how the elevator hoistways will perform during a fire. One of the most important issues is how stair pressurization affects the performance of the hoistway when the option of pressurizing the hoistway is chosen.

Sprinklered Buildings

A key observation in each of the historical fires cited is that the buildings (or at least the areas where the fires occurred) were unsprinklered. The discharge of water from operating sprinklers not only suppresses or extinguishes the fire, limiting the quantities and dynamics of the smoke, but also cools the air temperatures to near ambient levels. Even in the cases of fires shielded from the sprinkler discharge, ceiling temperatures are relatively low even though smoke and fire gas release rates can be increased due to incomplete combustion. Thus, in sprinklered buildings, there is little driving force to generate and cause migration of dangerous quantities of smoke and gasses around the building by way of stairways or hoistways.

Effectiveness and Reliability of Fire Safety Systems

This section provides a more thorough review of how the features of the building, whether passive or active, interact to control the fire and protect building occupants. This is demonstrated through the use of the Fire Safety Concepts Tree (NFPA 550).

Code intent and strategy

The intent of Section 713.14.1 requirements for an elevator lobby enclosure is to protect the elevator shaft from smoke infiltration and possible smoke spread onto other (non-fire) floors. ICC's International Building Code 2012 edition requires various fire safety systems and features based upon a building's use and occupancy, height and area, and construction type. These features are part of an overall strategy to protect the building occupants and emergency responders from fire. Primary fire safety systems and features are:

- Automatic fire sprinkler system
- Automatic and manual fire detection and alarm system
- Structural fire protection
- Floor construction
- Maximum travel distance to an exit
- Egress/exit shaft enclosure
- HVAC system controls
- Elevator hoistway enclosure
- Elevator hoistway venting

Fire Safety Concepts Tree Analysis

The effectiveness and interaction of these systems and features to achieve fire safety is described by NFPA 550 *Guide to the Fire Safety Concepts Tree* (the "Tree") 2007 edition (Appendix A). Rather than considering each fire safety system and feature separately, the *Tree* provides a "systems approach" to

fire safety, examines all fire safety systems holistically to determine how they influence the achievement of fire safety goals and objectives.

The *Tree* uses logic gates to show a hierarchical relationship of fire safety concepts. There are two types of logic gates in the *Tree*: "or" gates and "and" gates. An "or" gate, represented by a circle with a plus sign in it, indicates that any of the concepts below it will cause or have as an outcome based on the concept above it. An "and" gate is represented by a circle with a dot in the middle. This indicates that all of the concepts below the "and" gate are needed to achieve the concept above the gate. The *Tree* can be used to identify gaps and areas of redundancy in fire protection strategies.

As noted, elevator lobbies required by Section 713.14.1 are intended to limit smoke exposure to occupants on non-fire floors. Figure 3 illustrates the top tier gates of the *Tree* to accomplish that objective. The building code assumes the fire occurs, thus, the driving objective is to "manage fire impact" by "manage the fire" or "manage exposed."

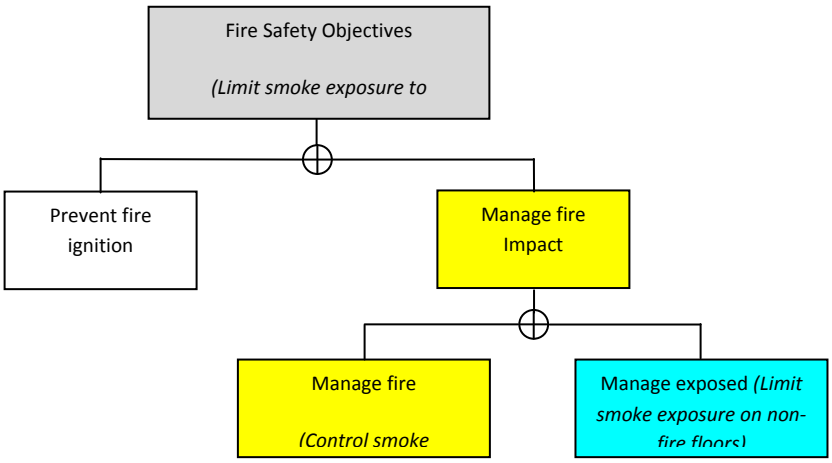


Figure 3: Top-gates of the Tree annotated with the intent of IBC §713.14.1

Figure 4 illustrates the two or three possible options to achieve "manage fire." Suppressing the fire by an automatic fire sprinkler system installed in accordance with IBC Chapter 9 **or** controlling fire (vertical migration) by construction features in accordance with IBC Sections 713 (shafts), 711 (horizontal assemblies), 716 (opening protectives) ***or*** venting fire/smoke that infiltrates into the elevator shaft in accordance with Section 3004 are each ways to limit the smoke exposure to occupants on non-fire floors. Controlling the combustion process, while identified as an option that can be used in general and used to a limited extent by the IBC's requirements for interior finish, is not practical or sufficient to solely achieve the objective in a building.

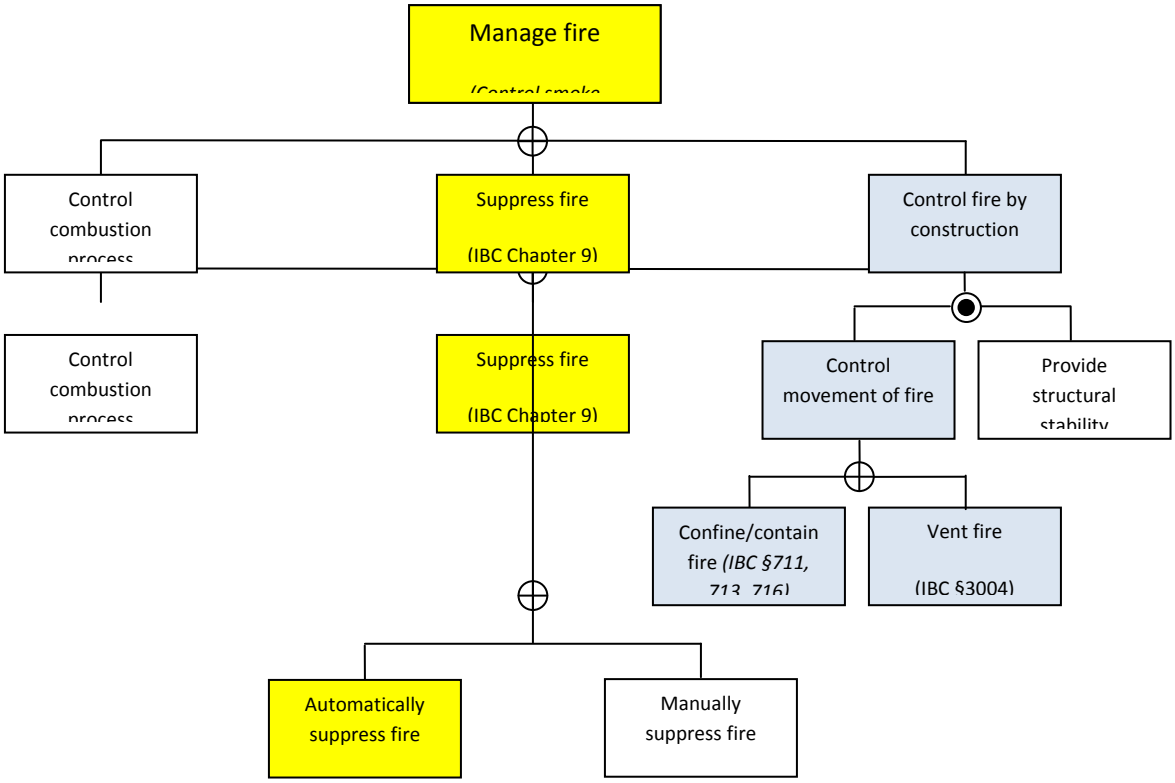
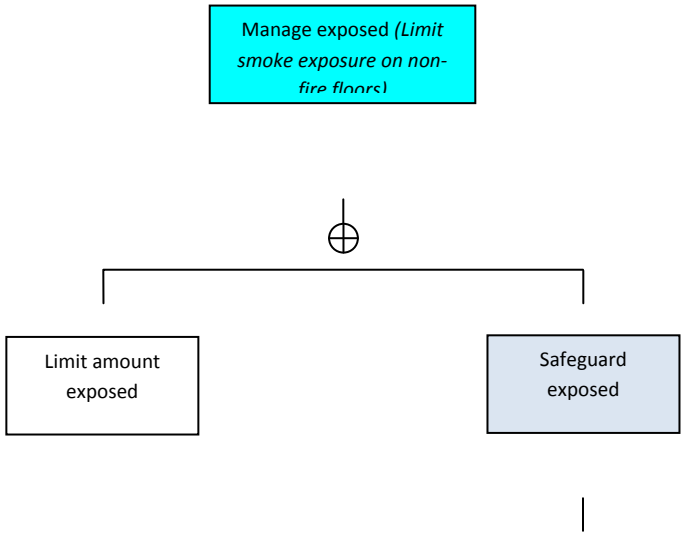


Figure 4: IBC 2012 required features and systems that contribute to limiting smoke production and migration to non-fire floors.

Figure 5 illustrates the options to achieve “manage exposed.” “Safeguard exposed” is accomplished by “defend-in-place” and “move exposed.” IBC Chapter 9 and Sections 403.3 and 403.4 require various fire safety systems to detect and alert the building occupants of a fire condition and to initiate evacuation. The provisions of IBC Chapter 10 and Section 403.5 both require various fire safety features and systems to protect the building occupants during egress or evacuation, thus limiting smoke exposure to occupants on non-fire floors. Section 403.2.3 requires egress stair and elevator hoistway enclosures in Risk Categories III and IV high rise buildings (Table 1604.5), and all buildings over 420 ft in height to exhibit impact resistance that resists the passage of fire and smoke into the shafts, minimizing the potential for inadvertent compromise of the enclosure.



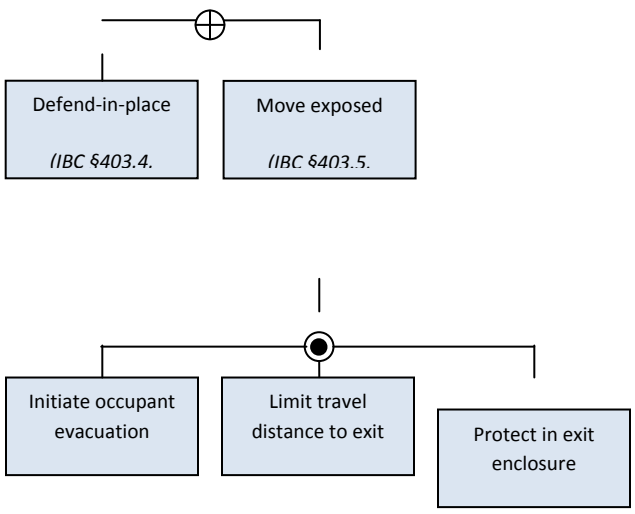


Figure 5: IBC 2012 required features and systems that limit smoke exposure to occupants on non-fire floors.

Fire Suppression Systems Availability

To address the automatic fire suppression (automatic sprinkler) system reliability, it is possible to use the Tree to show the primary system components, features and safeguards required by the IBC to ensure availability of suppression operation. The Tree can identify "single point failure" elements that could result in an unacceptable outcome in the event of a fire. This approach can be used in lieu of a quantitative risk analysis which requires system performance data, event tree and fault tree analysis, as well as occupant exposure analysis (an Available Safe Egress Time vs. Required Safe Egress Time comparative analysis). This could be a line diagram of an IBC-required sprinkler system in a high-rise building including the system components analysis as follows:

- A single sprinkler fails to operate:

  NFPA 13 requires that the design assume that multiple sprinklers will operate. In some cases this results in fire control vs. fire extinguishment which significantly reduces smoke production versus no sprinkler activation. This assumption provides a factor of safety and addresses the failure of a single sprinkler fails to operate.

- Sprinkler system floor control valve is closed/no water available:

  Statistically the most probable cause for sprinkler system failure is a closed water supply control valve. IBC Section 903.4 requires electronic supervision of water supply, monitored both on-site and off-site for increased reliability/availability.

  Section 403.3.1 requires buildings over 420 feet in height to be provided with two risers located in remote exit enclosures with each riser supplying the sprinklers on alternate floors. The sprinkler systems must be arranged such that a single closed floor control valve could at most result in failure of the sprinklers on one floor with those on the floors above and below still functional.

- Sprinkler/standpipe riser is out-of-service:

  IBC Section 905.2 requires all sprinkler/standpipe risers be interconnected at the base and control valves to be provided at the base of each riser providing redundancy and greatly reducing the potential of a loss of a sprinkler/standpipe riser.

- Automatic fire pump fails to operate:

  Pump failure: jockey pump operates, sufficient water supply for one- to two-sprinklers and building fire alarm notification. For buildings less than 420 ft. in height above fire department connection, fire department pumper is capable of supporting flow demand for either the sprinkler or standpipe systems.

- Pump failure due to no utility power supply:

  IBC Section 403.4.8 requires emergency power system for redundancy.

- No water in city/municipal water main or valve closed at connection to city/municipal water supply

  IBC Section 403.3.2 requires a connection to a minimum of two city water mains, minimizing the potential for loss of municipal water supply.

Reliability of Other Systems

Sprinkler systems are not the only fire protection feature within a building. Buildings typically have combinations of other types of fire protection features which may include fire and/or smoke rated walls, floor/ceiling assemblies, egress systems, detection systems, alarm systems, smoke control systems, and other mechanisms for protecting people from fire and the products of combustion.

The discussion above regarding sprinkler system reliability is an example of how a risk analysis might be approached. Similar types of analyses with potential failure modes for each of these other systems in a building would need to be performed for the other fire protection features in order for a risk analysis to be complete. Such a risk analysis could be performed using the same methodology as that used for the sprinkler system reliability discussion.

Recommendations for IBC Regarding Elevator Lobbies

Based on the forgoing, the following recommendations are suggested for consideration by the CTC:

6. Unsprinklered low- and mid-rise buildings (buildings with an occupied floor less than 55 feet above the lowest level of fire department vehicle access or less than 75 feet above the lowest level of fire department access with an occupant load less than 30 on each floor)

    - **No enclosed elevator lobbies required for traditional elevators.**

        - *Rationale: While fire temperatures can be high, causing smoke and gas migration throughout the building, occupants traveling at the typical rate of about 150 ft/min over the maximum permitted travel distance of 200 ft can reach the safety of an egress stairway in approximately 1.3 minutes and can descend to the level of exit discharge in less than five minutes. This time frame is merely an approximation but provides an indication of the required time necessary for egress in low and mid-rise buildings.*

          Additionally, code officials participating in the study group stated that lobbies have traditionally not been required in these type buildings in their jurisdictions and their experience has been good.

          Sprinklers are required in any building containing Fire service access (3007) and occupant evacuation (3008) elevators so these would not be found in buildings in this category.

          Elevator lobbies serving as an area of refuge in accordance with Section 1007.6 for accessible means of egress are required to be enclosed by smoke barriers

7. Sprinklered buildings with occupied floors less than or equal to 75 feet to the lowest level of fire department vehicle access:

    - **No enclosed elevator lobbies required for traditional elevators**

        - *Rationale: In sprinklered buildings fire temperatures are kept relatively low so hot gas expansion and buoyancy are not driving forces Traditional elevators are not to be used by occupants in fires, so any small infiltration into the hoistway is not significant. Shafts shorter than 75 feet have limited stack effect flows.*

    - **Enclosed lobbies required for fire service access (3007) and occupant evacuation (3008) elevators**

        - *Rationale: Fire service access and occupant egress elevators need to continue in operation during a fire. Lobbies provide a protected space to stage and to await the elevator and further provide a physical barrier to smoke that might activate a lobby smoke detector and trigger Phase I recall.*

8. Sprinklered buildings with an occupied floor more than 75 feet to the lowest level of fire department vehicle access and with elevator hoistway heights less than or equal to 420 feet.

    - **No enclosed elevator lobbies required for traditional elevators.**

        - *Rationale: In sprinklered buildings fire temperatures at the ceiling are kept relatively low so hot gas expansion and buoyancy are not driving forces. Traditional elevators are not to be used by occupants in fires, so any small infiltration into the hoistway is not significant. Shafts shorter than 420 feet have limited stack effect flows.*

    - **Enclosed elevator lobbies required for fire service access (3007) and occupant evacuation (3008) elevators**

        - *Rationale: Fire service access and occupant egress elevators need to continue in operation during a fire. Lobbies provide a protected space to stage and to await the elevator and further provide a physical barrier to smoke that might activate a lobby smoke detector and trigger Phase I recall.*

~~9.~~ Sprinklered buildings with hoistway heights more than 420 feet ~~in building height~~

    - **Enclosed elevator lobbies or pressurization of the elevator hoistways required for traditional elevators.**

- *Rationale: While traditional elevators are not permitted to be used in fires, the elevator hoistway height may result in smoke migration due to "stack effect" and spread to remote areas. Enclosed lobbies with smoke tight construction or pressurization of the hoistways will limit infiltration. The consequences of smoke spread in tall buildings with elevator hoistway heights over 420 feet was of greater concern to the Study Group.*

- **EXCEPTION:**

  3. Hoistways for traditional elevators separated into vertical sections not exceeding 420 feet in height with no communication of the hoistway environment between sections shall not require enclosed lobbies or pressurization as long as the following condition is met.

  4. Where connection of elevator banks is by a transfer corridor, it shall be necessary to pass through at least 2 swinging doors or a revolving door that maintains a separation of the environments to pass from one section to another.

  - *Rationale: By separating the hoistways into shorter sections and limiting communication of different shaft environments, both "stack effect" and smoke migration will be limited.*

- **Enclosed elevator lobbies required for fire service access (3007) and occupant evacuation (3008) elevators**

  - *Rationale: Fire service access and occupant egress elevators need to continue in operation during a fire. Lobbies provide a protected space to stage and to await the elevator and further provide a physical barrier to smoke that might activate a lobby smoke detector and trigger Phase I recall.*

10. Elevator hoistway pressurization design

- **The design of pressurization systems for elevator hoistways shall be based on a *rational analysis* in accordance with Section 909.4 that utilizes a network model approved by the AHJ and which includes an analysis of possible interactions between building shafts pressurized by different systems, and between pressurized and unpressurized shafts that exceed 420 feet in height.**

  Add guidance to commentary for 909.4 that the rational analysis should show that the pressurization design will maintain the estimated Fractional Effective Dose (FED) below 0.5 and the estimated visibility distance above 25

feet within the stairway for 1.5 times the estimated evacuation time for each of the design fires selected.

- *Rationale: Taller buildings with more complex flow paths require analysis utilizing a network model that can account for these interacting flow paths. The criteria suggested for commentary represents the standard of practice for a fire hazard analysis performed as the required rational analysis.*

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