Report to CTC for July 21-22, 2011 CTC Meeting

Elevator Lobby Study Group (SG)

7/ 12/2011

The following is a report of the work of the Elevator Lobby Study Group to the CTC. The scope and objectives of the SG are located below for reference. Basically there are 5 Task Groups (TGs) listed as follows which have reports included with this document:

- **TG1 Research.**
- **TG2 Need for elevator lobbies.**
- **TG3 Means of egress and elevator lobbies.**
- **TG4 Design and construction of Elevator lobbies.**
- **TG5 Standards.**

TG1 Research

This Task Group took the lead in assembling documents for background and research use by the rest of the task group. A list of references is found under the report of TG1. **See Attachment A.**

TG2 Need for elevator lobbies

This task group through extensive discussion has developed a technical analysis with recommendations where elevator lobbies should be required in the I-Codes. The draft technical analysis is attached for review. Once these recommendations are discussed by the CTC it is hoped that the group can move forward with more specific code changes to reflect the recommendations. Note that this group concurrently would also like to pursue a risk analysis. This will be discussed in more detail at the CTC meeting. **See Attachment B for a draft of the Technical Analysis**.

TG3 Means of egress and elevator lobbies.

This task group works on the assumption that the various types of elevator lobbies may be present in a buildings and how such enclosed lobbies affect the means of egress. Note for example that FSAE and

Occupant evacuation elevators require “direct access” to an interior exit stairway. **See Attachment C for a report and proposals.**

TG4 Design and construction of Elevator lobbies

This task group focused on the design and construction of enclosed elevator lobbies. There are various subcategories that are discussed in the report and proposals document. **See Attachment D for a report and proposals and Attachment E for a discussion on options for pressurization.**

TG5 Standards

No particular report from this group as it has not been necessary at this point.

CTC Study Group Elevator lobbies

Background

At the 2009 Code Development Hearings, a motion was passed by the IBC – Fire Safety committee that the issue of elevator lobbies, based on the significant number of code changes that have been submitted over the past cycles (09/10 – 16; 07/08 – 15; 06/07-4), be investigated in a forum outside of the code development process. The intent being that such a forum would provide a venue for involvement for governmental members as well as industry representatives to thoroughly review the issues.

Scope

The scope of the effort will focus on:

- 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

Objective:

The objective of this Area of Study is to develop code requirements which are responsive to identified

issues noted under “Scope” and which are technically substantiated, where possible.

Work Product:

Code changes to be submitted in the 2012/2013 Code Change Cycle for consideration in the 2015 I-Codes.

ATTACHMENT A

ICC CTC

Elevator Lobby Study Group

References

WEBSITE

- Beitel. J. J., Wakelin, A.J., Beyler, C. L., "Analysis of Smoke Movement in a Building Via Elevator Shafts," Prepared for Smoke Safety Council by Hughes Associates, March 2000.

- Ahrens, M "Reported Fires in High-Rise Structures in Selected Occupancies with and without Automatic Extinguishing Systems by Extent of Smoke Damage," Fire Analysis and Research Division, National Fire Protection Association, December 2010

- Budnick, E.K., Klote, J.H., Capabilities of smoke control, PART II--System Performance And Stairwell Pressurization

- Elevator Lobby CC History staff (06/07 through 09/10)

- Bukowski, R.W. "Is There a Need to Enclose Elevator Lobbies in Tall Buildings?," Building Safety Journal, Vol 3, No 4, 26-31, August 2005

- Klote, J. H., ***NBSIR 80 3757 An Analysis Of The Influence Of Piston Effect On Elevator Smoke Control***, US. DEPARTMENT OF COMMERCE National Bureau of Standards National Engineering Laboratory Center for Fire Research Gaithersburg, MD 20899, April 1988

- Klote, J. H., ***NBSIR 83 2715, Smoke Control for Elevators***, Prepared for the Veterans Administration by Us. Department Of Commerce, National Bureau of Standards National Engineering Laboratory Center for Fire Research Gaithersburg, MD 20899, June 1983

- Chapman, R. E., Butry, D.T., Huang, A.L., and Thomas, D.S. ***NIST Special Publication 1109 Economics of Egress Alternatives and Life-Safety Costs,*** U.S. Department of Commerce National Institute of Standards and Technology , Office of Applied Economics Building and Fire Research Laboratory Gaithersburg, Maryland 20899, September 2010

- Klote, J. H., ***NIST GCR 04 864 I Hazards Due to Smoke Migration Through Elevator Shafts – Volume I: Analysis and Discussion. Final Report***, U.S. Department of Commerce Building and Fire Research Laboratory National Institute of Standards and Technology, Gaithersburg, MD, 20899-8664, June 2004

- Klote, J. H., ***NIST GCR 04 864 II Hazards Due to Smoke Migration Through Elevator Shafts – Volume II: Results of Tenability Calculations. Final Report,*** U.S. Department of Commerce Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899-8664, June 2004

REFERENCES TG2 TECHNICAL ANALYSIS

- ASHRAE Handbook – Fundamentals, Ch 24, Owen, M. ed., ASHRAE, 2009.

- Bukowski, R.W., Is There a Need to Enclose Elevator Lobbies in Tall Buildings?, Building Safety Journal, Vol 3, No 4, 26-31, August 2005.

- Bukowski, R.W., Status of the Use of Elevators in Fires, Emerging Trends (online), SFPE, Bethesda, MD, 2008.

- Hall, J. R., "U.S. Experience With Sprinklers And Other Automatic Fire Extinguishing Equipment," NFPA, Quincy, MA 2010.

- Klote, J.H., Hazards Due to Smoke Migration Through Elevator Shafts – Volume I: Analysis and Discussion. Final Report**,** NIST GCR 04-864-1, Gaithersburg, MD, , 2004.

- Klote, J.H., Nelson, H.E. and Deal, S., Staging Areas for Persons with Mobility Limitations, NISTIR 4770, NIST, Gaithersburg, MD 1992.

- Klote, J.H. and Tamura, G.T., "Elevator Piston Effect and the Smoke Problem," Fire Safety Journal, Vol. 11, No. 3, pp. 227-233, December 1986.

- Klote, J.H., An Analysis of the Influence of Piston Effect on Elevator Smoke Control, NISTIR 88-3751, NIST, Gaithersburg, MD 1988.
- Marryatt, H.W., Fire, Automatic Sprinkler Performance in Australia and New Zealand, 1886-1968, Australian Fire Protection Association (Melbourne), ISBN 0959946101, 1971.

- Miller, R.S. and Beasley, D., On Elevator Shaft Pressurization for Smoke Control in Tall

- Buildings, in *Society of Fire Protection Engineers Professional Development Conference and Exposition* (2008), Charlotte, North Carolina.

- NIST CONTAM homepage http://www.bfrl.nist.gov/IAQanalysis/CONTAM/index.htm

- Sutherland, S., What's changed — and what hasn't — in the 100 years since the Triangle Waist Co. fire*, NFPA Journal,* NFPA Quincy, MA 02269, March/April 2011

- Tamura, G., Stack Effect and Building Design, NRCC CBD-107, Ottawa, Canada, 1968.

ATTACHMENT B

DRAFT TECHNICAL ANALYSIS OF THE NEED FOR ENCLOSED ELEVATOR LOBBIES

Prepared for the ICC CTC by the Elevator Lobby Study Group

CTC Proposals on Enclosed Lobbies for Elevators

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) to the greatest extent possible. This is usually accomplished by limiting the ignitability and burning rate of materials and by physical barriers (compartmentation). 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 moves smoke and fire gasses around a building is differences in temperature (and resulting differences in density) resulting from the fire and from the fact that the environment in 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.

One of the early lessons learned from fire disasters is the need to protect vertical 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. There are also a few examples of properly designed and constructed stairways that were compromised during a fire by doors that were propped open. These include the Prudential Building, Boston, MA, January 1986, and the Cook County Office Building, Chicago, IL., October 17, 2003.

Sprinklered Buildings

A key observation in each of these major fires is that the buildings (or at least the area where the fire 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 spray, temperatures are low while 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 move dangerous quantities of smoke and gasses around the building by way of stairways or hoistways.

Sprinkler Reliability

The definitive source for data on sprinkler systems reliability is Dr. John Hall at NFPA. According to his latest report [Hall, 2010] on the US experience with sprinklers,

> *"Sprinklers (of all types) operated in 91% of all reported structure fires large enough to activate sprinklers, excluding buildings under construction and buildings without sprinklers in the fire area.* When sprinklers operate, they are effective 96% of the time, resulting in a combined performance of operating effectively in 87% of all reported fires where sprinklers were present in the fire area and fire was large enough to activate them. The combined performance for the more widely used wet pipe sprinklers is 88%,…"*

Across all structures, wet-pipe sprinklers operate 92% of the time. The top reasons for non-operation are:

- 43% of failures to operate were attributed to the equipment being shut off,
- 16% were because manual intervention defeated the equipment,
- 12% were because water was discharged but did not reach the fire,
- 8% were because not enough water was discharged,
- 8% were because of lack of maintenance,
- 6% were because the equipment was inappropriate for the type of fire, and
- 6% were because a component was damaged.

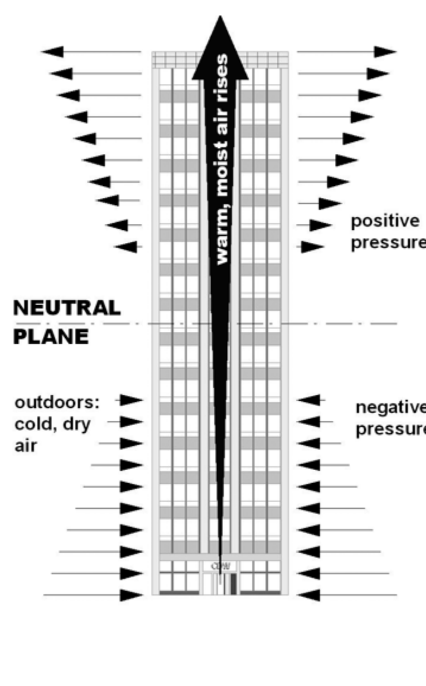
Many of these failure mechanisms have been mitigated through recent improvements in building code requirements and the applicable design standard, NFPA 13, "*Standard for the Installation of Sprinkler Systems,*" effectively "designing-out" the typical failure mechanisms. "Equipment shut off" typically refers to water supply valves being closed, either to the entire system or to the portion of the system in the area of origin. Valves can be electronically monitored (requiring a fire alarm system) but securing with a chain and lock is common, and permitted by NFPA 13. "Chain not reinstalled" is a common failure mode, but electronic monitoring cannot be defeated easily since these systems are required to signal tampering to a constantly-attended location. The International Building Code (IBC) Section 903.4 requires electronic monitoring of all valves with a fire alarm control unit that transmits a distinctive signal to an approved location. Chains and locks permitted to secure valves by NFPA 13 are not permitted by the IBC. In addition, requirements in the IBC for automatically transmitting an alarm upon sprinkler system activation to a constantly-attended location will result in a greater level of reliability than the data set included in the Hall study.

“Manual intervention” is not a failure of importance because the fire was extinguished by hose or fire extinguisher and is no longer producing heat, smoke or gas. “Water discharged but did not reach the fire” is also not significant because the sprinkler spray cools the environment and, even though smoke and gasses are produced, fires remain relatively small. The low air temperatures minimize the driving forces that push the fire products to and up building shafts. “Not enough water discharged” usually refers to systems that ran out of water too soon, such as when too many sprinklers open. Recent changes in NFPA 13, requiring hydraulically-designed systems and faster-operating sprinklers have greatly reduced the likelihood of such occurrences when compared to the universe of sprinkler systems installed over the last hundred years. In any case, the effect would be similar to “water discharged but did not reach the fire” because significant cooling occurs even where it is not sufficient to extinguish the fire. “Inappropriate for the type of fire” is most common in storage occupancies where the commodity for which the system was designed was replaced with a commodity that required a higher water density, and the system was not upgraded. Such failures are not typical in high-rise residential and office buildings.

Based on this analysis, only “lack of maintenance” and “component damaged” would be of significance for failure of systems that are electronically monitored, resulting in an estimated reliability of 98.9%. This reliability rate is also consistent with the reliability data published by Marryatt for commercial office and residential occupancies in which he studied electrically-supervised sprinkler systems having flow and tamper signals automatically transmitted off-site. [Marryatt, 1971]

Stack Effect

Stack effect is defined as air flow in vertical 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 will be induced in any open shaft in a building, including mechanical, plumbing, and electrical shafts. Stack effect creates the most problems in elevator hoistways because these shafts 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 it doesn't close fully, the elevator cannot leave the floor. It is reported 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.

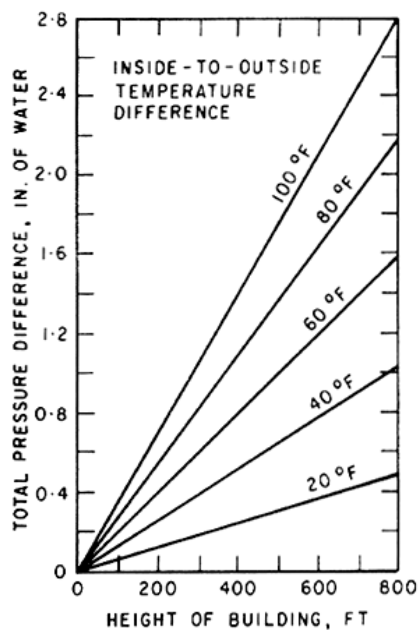


Figure 2 – Pressures Produced by Stack Effect Across Landing Doors

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 a hazard (smoke) present and pressure differences to drive it to and up (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 only slightly elevated, so there is no significant driving force. Sprinklered fires produce small quantities of smoke/toxic gasses. [Klote 2004; Klote 1992]

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 vertical 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) hoistway range from just over 1000 CFM to just over 4000 CFM over 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 breaking the shafts 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 this 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 height.

2. Protecting occupants during a fire (safe place)

Since elevators are not to be used in fires except those designated explicitly for Fire Service [3007] and Occupant Egress [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 of 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 Firefighter Recall Operation (FEO) will take the elevators out of service to the level of exit discharge before smoke can enter the hoistway, regardless of whether an enclosed lobby is provided. In 3007- and 3008-type elevators, 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 Lobbies

Elevator lobbies are permitted to be eliminated where additional doors [3002.6] or pressurized hoistways [708.14.2] are provided. Pressures are required by the IBC to be between 0.1 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 group discovered that common practice for mechanical designers is to utilize unconditioned outside air to pressurize the hoistway and to pressurize stairways.

Filling vertical 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. According to one mechanical engineer, even where only the stairways are pressurized with unconditioned air, the temperature in the hoistways will be driven toward the outside temperature because air moving into the stair will leak into the building and flow into other shafts, including hoistways

However, the 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, and 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. Note that 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 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].

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 these network models for high-rise buildings and 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,
- Buildings that contain a parking garage, whether open or enclosed,
- Buildings that contain both pressurized stairways and pressurized hoistways, and
- Buildings that contain stacked atria.
- Buildings containing atria with mechanical smoke control
- Buildings containing shafts taller than 420

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.

Recommendations for IBC regarding elevator lobbies

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

1. Unsprinklered low- and mid-rise buildings (buildings with an occupied floor less than 55 feet above the lowest level 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, driving smoke and gasses around 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 about 1.3 minutes and can descend to the level of exit discharge in less than five minutes. This is merely an approximation but provides an indication of the amount of time necessary for egress in low and mid rise buildings. Also, some 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.
2. Sprinklered buildings with occupied floors less than 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 low and such buildings have little stack effect. 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.*
3. Sprinklered buildings with an occupied floor more than 75 feet to the lowest level of fire department vehicle access but less than 420 feet in building height
    - No enclosed elevator lobbies required for traditional elevators.
        - *Rationale: In sprinklered buildings fire temperatures are kept low and such buildings have little stack effect. Traditional elevators are not to be used by occupants in fires, so any small infiltration into the hoistway is not significant.*
    - 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.*
4. Sprinklered buildings more than 420 feet in building height
    - Enclosed elevator lobbies or pressurization of the hoistways required for traditional elevators.
        - *Rationale: While traditional elevators are not permitted to be used in fires, the shaft height might result in more inadvertent smoke infiltration due to stack effect and spread to remote areas. Enclosed lobbies with smoke tight*

construction or pressurization of the hoistways will limit infiltration. Further consideration and discussion is needed regarding the threshold of 420 feet.

- 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.*
- EXCEPTION: Hoistways for traditional elevators separated into vertical sections not exceeding 420 feet in height with no communication of the shaft environment between sections shall not require enclosed lobbies or pressurization as long as the following condition is met.
    - 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 breaking shafts into shorter sections and limiting communication of different shaft environments, both stack effect and smoke migration will be limited to the extent that pressurization of the hoistways is not required.*

5. 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 preformed as the required rational analysis.*

References

ASHRAE Handbook – Fundamentals, Ch 24, Owen, M. ed., ASHRAE, 2009.

Bukowski, R.W., Is There a Need to Enclose Elevator Lobbies in Tall Buildings?, Building Safety Journal, Vol 3, No 4, 26-31, August 2005.

Bukowski, R.W., Status of the Use of Elevators in Fires, Emerging Trends (online), SFPE, Bethesda, MD, 2008.

Hall, J. R., U.S. EXPERIENCE WITH SPRINKLERS AND OTHER

AUTOMATIC FIRE EXTINGUISHING EQUIPMENT, NFPA, Quincy, MA 2010.

Klote, J.H., Hazards Due to Smoke Migration Through Elevator Shafts – Volume I: Analysis and Discussion. Final Report**,** NIST GCR 04-864-1, Gaithersburg, MD, , 2004.

Klote, J.H., Nelson, H.E. and Deal, S., Staging Areas for Persons with Mobility Limitations, NISTIR 4770, NIST, Gaithersburg, MD 1992.

Klote, J.H. and Tamura, G.T., "Elevator Piston Effect and the Smoke Problem," Fire Safety Journal, Vol. 11, No. 3, pp. 227-233, December 1986.

Klote, J.H., An Analysis of the Influence of Piston Effect on Elevator Smoke Control, NISTIR 88-3751, NIST, Gaithersburg, MD 1988.

Marryatt, H.W., Fire, Automatic Sprinkler Performance in Australia and New Zealand, 1886-1968, Australian Fire Protection Association (Melbourne), ISBN 0959946101, 1971.

Miller, R.S. and Beasley, D., On Elevator Shaft Pressurization for Smoke Control in Tall

Buildings, in *Proc Society of Fire Protection Engineers Professional Development Conference and Exposition* (2008), Charlotte, North Carolina.

NIST CONTAM homepage http://www.bfrl.nist.gov/IAQanalysis/CONTAM/index.htm

Sutherland, S., What's changed — and what hasn't — in the 100 years since the Triangle Waist Co. fire*, NFPA Journal,* NFPA Quincy, MA 02269, March/April 2011

Tamura, G., Stack Effect and Building Design, NRCC CBD-107, Ottawa, Canada, 1968.

ATTACHMENT C

TG3 REPORT AND PROPOSALS

The following are proposals and discussions related to enclosed elevator lobbies and egress. These proposals were developed based upon the fact that an elevator lobby whether traditional, FSAE or Occupant evacuation elevator lobbies were required. The following were topics discussed by TG3.

1. **Exit access through lobbies.**
2. **Direct access.**
3. **Dead end corridors**
4. **Conflicting Door swings**

1. Exit Access Through Lobbies. Access to egress paths addressed the issue of whether restrictions on the number of paths of egress through the elevator lobby should be implemented. Based upon the intent of the code it was felt that exit access through elevator lobbies should be limited only for occupant evacuation elevators and traditional elevators. Occupant evacuation elevators are specifically drawing occupants to the lobby. It would not be appropriate to allow a tenant space with all egress paths having to go through the enclosed lobby to get to a stair since they will be working against the traffic flow of egress. Traditional enclosed elevator lobbies if required are mandated with a concern for smoke migration in the elevator hoistway. Therefore it would not be prudent to allow both paths of egress to pass through the enclosed lobby. FSAE cause less concern as the occupants will likely not interfere with FS operations and are not specifically pulling occupants to those areas as they elevators are not for egress.

This proposal addresses traditional, occupant evacuation and fire service access elevator with regard to the allowances for egress and also provides a proposed pointer within the rated corridor section. See draft proposal as follows:

Revise as follows:

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. Egress through an elevator lobby shall be permitted in accordance with Section 1014.2 item 5

3007.7 Fire service access elevator lobby. The fire service access elevator shall open into a fire service access elevator lobby in accordance with Sections 3007.7.1 through 3007.7.5. 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.

3008.7 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.

Add a new item 5 to section 1014.2

5. Exit access through an enclosed elevator lobby~~, not required by Section 3007,~~ is permitted. Access to at least one of the required exits shall be accomplished without travel through the enclosed elevator lobbies required by Section 713.14.1 and Section 3008.

Access through fire service access elevator lobbies is not restricted.

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.

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*.

Exceptions: 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.

Reason: First the purpose of elevator lobbies is first discussed. The code itself does not state what the purpose of a traditional elevator lobby is but historically and to a certain extent from the code commentary there are several purposes that could be concluded.

- Prevent smoke from spreading from the floor of fire origin through the elevator hoistway.
- Protect occupied areas from smoke spread from the elevator hoistway

In the case of FSAEs and Occupant Evacuation elevators there are additional purposes such as providing a staging area for fire fighters, a protected area for occupants awaiting egress and also to delay the automatic activation of phase 1 recall. Note that Both FSAE and Occupant evacuation elevators require direct access to an exit within the lobby.

Based upon the intent of the code it was felt that exit access through elevator lobbies should be limited only for occupant evacuation elevators and traditional elevators. Occupant evacuation elevators are specifically drawing occupants to the lobby. It would not be appropriate to allow a tenant space with all egress paths having to go through the enclosed lobby to get to a stair since they will be working against the traffic flow of egress. Traditional enclosed elevator lobbies if required are required with a concern for smoke migration in the elevator hoistway. Therefore it would not be prudent to allow both paths of egress to pass through the enclosed lobby.

The last sentence of the proposed item 5 also clarifies that if an egress path passes through a lobby with more restrictive construction that the level of construction does not need to be continued to the exit.

The new exception to Section 1018.1 clarifies also that travel is permitted through an enclosed elevator lobby if the enclosed elevator lobby is located in a rated corridor.

2. Direct Access. The second issue addressed by this committee was direct access to an interior exit stairway as required for occupant evacuation elevators and fire service access elevators. Both FSAE and Occupant Evacuation elevators lobbies call for direct access to the stairway. The term direct access is not necessarily clear in its meaning and can provide logistic problems with building design. The intent originally is believed to be a stair within the lobby itself. The debate has been whether an alternative is needed to locating the interior exit stairway next to the elevator. The debate has been whether such an option should extend the interior exit stairway protection or if the lobby requirements should be extended. The following proposal allows the extension of construction similar to the lobby via corridor construction. A door is being required at the entrance of the lobby space with smoke and draft protection.

Revise as follows:

3007.7.1 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.

3008.7.1 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.

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.

Reason: Both FSAE and Occupant Evacuation elevators lobbies call for direct access to the stairway. The term direct access is not necessarily clear in its meaning and could if applied as intended place severe design limitations on some buildings. The intent of this proposal is to set out a viable option for the stairs to be more remotely located from the lobby. A package of requirements that provides fire resistance rated construction and smoke and draft protection is provided. A definition is also provided for discussion. It is not clear whether the proposed language itself is self explanatory or if a definition is also necessary.

Background sections for the separation requirements are as follows:

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 and open mall buildings* as required by Section 402.4.2.1.

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.

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 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.

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 m3/s □□ m2) 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.

716.5.3.2 Glazing in door assemblies. In a 20-minute *fire door assembly*, the glazing material in the door itself shall have a minimum fire-protection-rated glazing of 20 minutes and shall be exempt from the hose stream test. Glazing material in any other part of the door assembly, including transom lights and sidelights, shall be tested in accordance with NFPA 257 or UL 9, including the hose stream test, in accordance with Section 716.6.

Background information on the term “direct access” is as follows:

ANCHOR BUILDING. An exterior perimeter building of a group other than H having direct access to a *covered or open mall building* but having required *means of egress* independent of the mall.

405.4.3 Elevators. Where elevators are provided, each compartment shall have direct access to an elevator. Where an elevator serves more than one compartment, an elevator lobby shall be provided and shall be separated from each compartment by a s*moke barrier* in accordance with Section 709. Doors shall be gasketed, have a drop sill and be automatic-closing by smoke detection in accordance with Section 716.5.9.3.

407.4.1 Direct access to a corridor. Habitable rooms in Group I-2 occupancies shall have an *exit access* door leading directly to a *corridor*.

505.2.3 Openness. A *mezzanine* shall be open and unobstructed to the room in which such *mezzanine* is located except for walls not more than 42 inches (1067 mm) in height, columns and posts.

Exceptions:

1. *Mezzanines* or portions thereof are not required to be open to the room in which the *mezzanines* are located, provided that the *occupant load* of the aggregate area of the enclosed space is not greater than 10.

2. A *mezzanine* having two or more *means of egress* is not required to be open to the room in which the *mezzanine* is located if at least one of the *means of egress* provides direct access to an *exit* from the *mezzanine* level.

3. …

1007.6 Areas of refuge. Every required *area of refuge* shall be *accessible* from the space it serves by an *accessible means of egress*. 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. Every required *area of refuge* shall have direct access to a *stairway* complying with Sections 1007.3 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 1022.10 for smokeproof enclosures except where the elevators are in an *area of refuge* formed by a *horizontal exit* or smoke barrier.

1007.7.2 Outdoor facilities. Where *exit access* from the area serving outdoor facilities is essentially open to the outside, an exterior area of assisted rescue is permitted as an alternative to an *area of refuge*. Every required exterior area of assisted recue shall have direct access to an *interior exit stairway*, exterior *stairway*, or elevator serving as an *accessible means of egress* component. The exterior area of assisted rescue shall comply with Sections 1007.7.3 through 1007.7.6 and shall be provided with a two-way communication system complying with Sections 1007.8.1 and 1007.8.2.

1027.1 General. *Exits* shall discharge directly to the exterior of the building. The *exit discharge* shall be at grade or shall provide direct 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.

1105.1.1 Parking garage entrances. Where provided, direct access for pedestrians from parking structures to buildings or facility entrances shall be *accessible*.

1105.1.2 Entrances from tunnels or elevated walkways. Where direct access is provided for pedestrians from a pedestrian tunnel or elevated walkway to a building or facility, at least one entrance to the building or facility from each tunnel or walkway shall be *accessible*.

TABLE 2902.1

c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted where such room is provided with direct access from each patient sleeping unit and with provisions for privacy.

3007.7.1 Access. The fire service access elevator lobby shall have direct access to an enclosure for an *interior exit stairway*.

3008.7.1 Access. The occupant evacuation elevator lobby shall have direct access to an *interior exit stairway* or *ramp*.

3109.4.1.8 Dwelling wall as a barrier. Where a wall of a *dwelling* serves as part of the barrier, one of the following shall apply:

1. Doors with direct access to the pool through that wall shall be equipped with an alarm that produces an audible warning when the door and/or its screen, if present, are opened. The alarm shall be *listed* and labeled in accordance with UL 2017. In dwellings not required to be *Accessible units*, *Type A units* or *Type B units*, the deactivation switch shall be located 54 inches (1372 mm) or more above the threshold of the door. In dwellings required to be *Accessible units*, *Type A units* or *Type B units*, the deactivation switch shall be located not higher than 54 inches (1372 mm) and not less than 48 inches (1219 mm) above the threshold of the door.

3. Dead end corridors due to stair shifts. There is a concern specific to occupant evacuation elevators and FSAEs related to dead end corridors that may be created as a result. More specifically, since direct access to a stair must be provided from the lobby the location of the stairs may shift and possibly cause issues with dead end corridors and travel distance. There will likely be an avoidance of a third stair to address this so it may create some awkward layouts. In buildings with a core design it may not be as difficult to address.

The proposals drafted addressing direct access will allow more flexibility which will reduce this problem. In addition, at least one path of egress can pass through the enclosed elevator lobby (as currently proposed) which provides some level of flexibility in design.

4. Conflicting doors/door swing. This issue is more specific to FSAE and the many doors required. The code currently requires direct access from the lobby to a stairway and additionally an entrance to the same stairway from the corridor based upon standpipe access issues. Depending upon how the stairway is laid out issues with conflicting doors may arise. Also there is concern that this particular requirement for essentially 2 doors on each story may cause difficulty in design and also some confusion for occupants and Fire fighters as to where to go.

A proposal has not been assembled at this time but will likely involve signage to avoid conflict. Note that depending upon how the concept of direct access is addressed this may affect this issue. More specifically if the interior exit stairway is accessed down a protected path it may already satisfy the requirements of Section 3007.10.1 for access directly to the floor without passing through the enclosed elevator lobby.

ATTACHMENT D

TG4 REPORT AND PROPOSALS

Task Group 4 was charged with addressing the design and construction of enclosed elevator lobbies. Note that there were basically three types of elevators and associated enclosed elevator lobbies of interest which included the following.

- **Traditional (Section 713.14.1)**
- **FSAE (Section 3007)**
- **Occupant Evacuation Elevators (Section 3008)**

There were several subcategories of topics with regard to the design and construction of enclosed elevator lobbies that were to be reviewed. These subcategories were as follows:

1. **Dimensions of Elevator Lobbies**
2. **Location of Elevator Lobbies**
3. **Separation of Elevator Lobbies**
4. **Pressurization of Hoistways and Elevator Lobbies.**
5. **Roll Down Type Barriers, Sliding Doors & Additional Doors**
6. **Gasket Systems**
7. **Additional Issues**

1. Dimensions of Elevator Lobbies. The issue of whether or not the lobby sizes mandated in Section 3007 and 3008 were appropriate was discussed at some length. The main focus was on the FSAE lobbies and whether they would work with fire fighting operational needs. Also a question based upon some interpretation of this section as to whether each FSAE would require an increase in lobby size. Proposals such as G197-07/08 were reviewed for intent. The conclusion was

- Current lobby size requirements for both FSAE and Occupant evacuation elevator were appropriate
- Size requirements for FSAE were only intended to apply one time. In other words the area did not need to increase by 150 square feet for each addition FSAE. This is important as the 2012 IBC now requires 2 FSAEs.

See **Proposal 3** for clarification of the size requirements.

2. Location of Elevator Lobbies. This issue was focused more upon where lobbies were required though TG2 was charged with determining if an enclosed elevator lobby was necessary. No changes were proposed for this topic except to clarify the difference between enclosed elevator lobbies and unenclosed elevator lobby. This makes application of the provisions clear as the term "elevator lobby" is used whether or not the lobby is enclosed such as the first floor lobby in a high rise building. See **Proposal 7.**

3.Separation of Elevator Lobbies. This issue related specifically to what types of separations were required of enclosed elevator lobbies in the I-Codes. There are three types of lobbies the group has discussed including what has been termed a traditional elevator lobby, FSAE lobby and Occupant Evacuation Elevator lobby. The basic construction requirements are as follows:

> **Traditional Elevator lobby.** 1 Hour fire partitions but note that Section 713.14.1 sets out several exceptions which would allow alternate methods of protection such as a smoke partition with sprinkler protection.
>
> **FSAE Lobby.** Smoke barrier construction.
>
> **Occupant evacuation elevators.** Smoke barrier construction.

Generally the types of separations were not questioned but instead clarity in application of some of the code requirements was addressed. The following of some of the specific issues addressed.

Smoke barrier continuity. There was concern that the code does not currently allow termination of a smoke barrier at the shaft enclosure and that smoke and draft assemblies would then be required at the opening into the hoistway. **Proposal 4** addresses this issue.

Area of refuge consistency. Section 1007.6 currently requires the protection afforded for an enclosed elevator lobby through the use of a smoke proof enclosure. More clarity on construction was necessary as smokeproof enclosures are intended for an interior exit stairway and not an elevator lobby. See **Proposal 5**. Note that there are some suggested revisions still under review for this proposal. One of the key issues is whether the intent of smokeproof enclosures should be taken as a whole or just the construction requirements. In other words, in addition to separation was there also an intent to provide pressurization of the hoistway and lobby? Note that a smokeproof enclosure would be separated with fire barriers versus smoke barriers.

Corridor continuity. An area of confusion pointed out to the TG was that it is often interpreted that if a corridor is required to be rated in accordance with Section 1008 that when an elevator opened onto that corridor that smoke and draft protection would still be required even if the elevator lobby requirements were not applicable. The concern with this approach is that this would then essentially be another elevator lobby requirement indirectly applied through the corridor requirements. The logic of the proposal provided was to clarify that if an enclosed elevator lobby was not required by Section 713.14.1 then protection for the corridor would not be necessary. See **Proposal 6**.

4. Pressurization of Hoistways and Elevator Lobbies. TG4 spent extensive time discussing the viability of hoistway pressurization as an alternative to the main traditional elevator lobby requirements in Section 713.14.1. The concern was whether such a system would be effective. As part of this analysis various types of pressurization strategies were summarized. Also, the affect of stack effect within buildings was discussed and reviewed at length. Initially the conclusion was that there were hoistway height limitations on the use of this options but with more information provided on the use of outside air for pressurization systems the affect of stack effect on such systems is minimized. More discussion of this concept is found in the report presented by TG2. There may be extreme conditions where limitations should be placed upon systems but generally the concept as written in the code currently is satisfactory.

It should be noted that the discussion of this topic also did raise questions with regard to what should occur when a rational analysis is undertaken. Future discussions of this group and TG2 may lead to a proposal to strengthen the requirements for a rational analysis in Section 909.

5. Roll Down Type Barriers, Sliding Doors & Additional Doors. The 'Additional door' allowance in the elevator lobby requirements existed in the Uniform Building Code (ICBO) since 1991 (three editions), and then was carried over to the IBC 2000 and each successive IBC edition since them (four editions). It is believed that the rationale for these doors was that they were meant to be a design option used primarily to allow the designer the ability to avoid the additional space required by a fully enclosed lobby while still meeting the elevator lobby requirements.

It is generally accepted that the requirements in the IBC for 707.14.1 (IBC 2000 → IBC 2006), 708.14.1 (IBC 2009) and 713.14.1 (IBC 2012) are part of the shaft protection requirements, and the sole function of the elevator lobby requirement in Chapter 7 is to serve as a barrier against smoke infiltration into the hoistway from a fire on the floor of origin, or alternately if smoke has made it into the elevator shaft, to prevent smoke from escaping onto other floors remote from the fire. The fire service does not typically stage in the elevator lobby nor when they use the elevators do they even approach any closer than 1 – 2 floors below the lowest known fire location. The elevator lobby requirements in Chapter 7 also have never been intended to meet the requirements for areas of refuge which are in Chapter 10 and are more extensive. The lobby requirements for the newly created fire service access elevators and the occupant evacuation elevators are found in Chapter 30 and clearly are intended to provide 'safety areas' during fire events for those particular designs. In the UBC legacy code and in the IBC Chapter 7 requirements for elevator lobbies, there has never been a minimum space requirement.

The most common instance for the additional door design to be used is when the elevator hoistway door opens directly into the corridor. Instead of offsetting the hoistway away from the corridor to provide space for a small enclosed vestibule, typically a 20 minute fire rated door and frame, which also carries an "S" rating, is mounted directly in front of the hoistway opening. The door frame is attached to the corridor wall in such a way that the hoistway door frame fire rating is not compromised. Typically the additional doors are restrained (open) by magnetic hold opens and released upon some alarm signal which can range from a general alarm to only releasing when the elevator system enters Phase 1. Note that this particular issue is somewhat controversial as to whether the corridor requirements would drive the need for an elevator lobby. Please see **Proposal 6** for more discussion on this issue.

There are three areas of supplemental requirements when the 'additional door' option is chosen. The first is found in Exception 3 which requires that the "S" rating be achieved without taping the undercut; taping of the undercut is normally a common practice when testing to UL 1784. The second area is found in Chapter 30 which states that

> ***3002.6 Prohibited doors.*** *Doors, other than hoistway doors and the elevator car door, shall be prohibited at the point of access to an elevator car unless such doors are readily openable from the car side without a key, tool, special knowledge or effort.*

The third area is in meeting the minimum corridor widths. The path of the additional door swing through the corridor shall not encroach on more than 50% of the minimum corridor width.

The presence of an additional door is also recognized and permitted in the Elevator Code, however there are a few more performance requirements in the Elevator Code when this design option is chosen than are found in the Building Code. Section 2.11.6.3 of the elevator Code addresses this issue. Also note that this section requires the fire department to be able to visually observe the elevator landing (lobby).

Below is the commentary for the 2009 IBC 708.14.1 exception 3.

> Exception 3 eliminates the need for a lobby area, but still requires the additional layer of fire resistance and smoke control. Doors, in addition to the normal hoistway door, are provided in front of the hoistway opening. These doors or door must meet the following two requirements:
>
> 1. They must be easily opened in accordance with Section 3002.6. This ensures that if the door or doors do close that they can be opened by someone who arrives at that level on the elevator, such as fire department personnel. This is particularly important if the doors are horizontal power-operated doors, such as those in Section 1008.1.4.3. Section 3002.6 states that the doors shall be readily openable from the car side without a key, tool, special knowledge or effort.
>
> 2. Additional door or doors must be tested in accordance with UL 1784. This test is titled "Air Leakage Tests of Door Assemblies." This test does not provide a fire-resistance rating for the door. This test has no failure criteria as it only measures the leakage rate. The leakage rate for smoke and draft control doors in Section 715.4.3.1 is a maximum of 3 cubic feet per minute per square foot (0.0014 m^3/s) of door opening at 0.10 inch of water column pressure (0.02 kPa). It is assumed that they must meet the leakage rate requirements in Section 715.4.3.1, and they must be identified as smoke and draft control doors in accordance with Section 715.4.6.3.

Commentary for Section 3002.6 is as follows:

> Where a door is installed in front of the hoistway door to meet the hoistway opening protection requirements in Section 708.14.1 (Exception 3) or for security purposes this section requires that occupants be able to open the door. Inappropriate installation of these doors could lead to occupants becoming trapped in the area between the elevator doors and the additional set of doors. See Figure 3002.6 for a picture of an additional door located at the hoistway opening.

Figure 3002.6 ADDITIONAL DOOR IN FRONT OF HOISTWAY

At this time there are no proposals to revise the requirements in the IBC with regard to this issue.

6. Gasket Systems. This topic was researched by the TG and based upon such research was determined that the use of gasketing systems was not appropriate. More specifically through discussion with those in the elevator community the use of gasketing is not preferred due to the practical difficulties of such gasketing. One such issue is related to concerns with the ability of hoistway door closure. Section 2.11.19 of ASME A17.1 addresses the gasketing of hoistway entrances. This section requires testing of the gasketing material to one of the following fire door testing standards:

- UL 10b
- NFPA 252 or
- CAN4 –S104

It also requires compliance with the maximum elevator temperature tests of UL 1784 without deterioration. The gasketing must be labeled.

Based upon these findings no proposals were necessary with regard to gasketing.

7. Additional Issues

Relocation of provisions to chapter 30. Based upon discussion of TG4 and TG32 members it was suggested to retain more consistent provisions for elevator lobbies that the provisions be relocated to chapter 30 from chapter 7. A draft of such a revision is seen in **Proposal 1**.

Revision of exceptions to permissions. Since each of the exceptions in Section 713.14.1 are of equal weight it was suggested that the provisions be revised from exceptions to allowances. A draft of a such an approach is seen in **Proposal 2**.

PROPOSAL 1.

LOBBY REQUIREMENTS CHAPTER 30

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

SECTION 3007

ELEVATOR LOBBIES

3007.1 General. Where required by Section 713.14 (or should it be 713?), enclosed elevator lobbies shall be provided in accordance with this section. For FSAE see requirements in Section 3007. For occupant evacuation elevators see requirements in Section 3008.

3007.2 ~~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 406.5.

3007.3~~713.14.1.1~~ Areas of refuge. Areas of refuge shall be provided as required in Section 1007.

Reason: This proposal is editorial in nature but is done with hopes of keeping the lobby requirements easier to apply and more consistent in the future. Section 3007 and 3008 currently house the requirements for Fire Service Access Elevators and Occupant evacuation elevators which have lobby constructions requirements associated with them. Section 714.12 now simply references users in this proposal to the appropriate sections within Chapter 30 for elevator lobby requirements. This way code users will be clear that there are several types of lobbies and that more than one set of requirements and triggers may apply to them. This also assists with correlation with ASME A17.1.

PROPOSAL 2

EXCEPTIONS TO PERMISSIONS

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 Opening protection. An elevator opening shall be protected where an elevator shaft connects more than three stories, is required to be in a shaft in accordance with Section 712.1 and where one of the following conditions apply.

1. The building is not protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2

2. The building contains a Group I-2 occupancy;

3. The building contains a Group I-3 occupancy;

4. The building contains elevators serving floor levels over 75 feet above the lowest level of fire department vehicle access in high-rise buildings.

713.14.~~1~~2 Elevator opening protection options ~~Lobby~~. Where section 713.14.1 requires protection of the elevator opening into the hoistway one of the following protection options shall be used.

1. ~~An enclosed elevator lobby shall be provided at each floor where an elevator shaft enclosure connects more than three stories. The~~ An enclosed lobby that separates ~~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.~~

2. An enclosed lobby that separates the elevator shaft enclosure doors from each floor by smoke partitions where the building is equipped throughout with an automatic sprinkler system installed in accordance with 903.3.1.1 or 903.3.1.2. Elevator lobbies shall have at least one means of egress complying with Chapter 10 and other provisions within this code. 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.

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.~~

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

Exceptions:

1.~~**7.**~~ Protection of elevator openings into a shaft enclosure~~Enclosed elevator lobbies~~ are not required where the elevator serves only open parking garages in accordance with Section 406.5.

2. Protection of elevator openings into a shaft enclosure 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.

713.14.2~~1~~.1 Areas of refuge. Areas of refuge shall be provided ~~as~~ where required in Section 1007.

Reason: The purpose of this code change is editorial in nature and seeks only to convert the elevator lobby section to one focused on making the current exceptions equal in stature in the code to the main requirement for a lobby. This also removes some of the confusion with having requirements within some of the exceptions. This proposal focuses on the protection of the elevator opening into the shaft enclosure versus requiring an elevator lobby. This allows the other exceptions to become more clear and equal design options.

PROPOSAL 3

LOBBY SIZE CLARIFICATION

3007.7.4 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 m2) in an area with a minimum dimension of 8 feet (2440 mm).

Reason: This proposal is to clarify that it was not the intent to require additional space for each additional fire service access elevator provided. The initial intent of the size requirement was merely to provide sufficient space to conduct fire fighting operations. The 2012 IBC has a new requirement for a second fire service access elevator which was not related to the section on lobby size. This second elevator was initially discussed as being needed for additional capacity but when discussed on the floor was noted as being more for redundancy.

The current size requirement is the result of a successful Public Comment to Code Change G197-07/08 submitted by the proponent representing the Los Angeles Fire Department. The proponent originally wanted 50 square feet for each additional elevator car served by the lobby but that was disapproved by the General Committee. The Public Comment deleted the 50 square feet and added the minimum dimension requirement of 8 feet. A detailed rationale for that approach can be found in the Commenter's Reason submitted with the Public Comment. So this proposed code change implements and clarifies the intent of the Public Comment that was approved by the ICC Class A voting members.

PROPOSAL 4

SMOKE BARRIER CONTINUITY

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, 3007.4.2 or 3008.11.2 shall be permitted to terminate at the elevator hoistway shaft enclosure. ~~not required to extend from outside wall to outside wall.~~ For the purposes of this exception, a smoke and draft control assembly as specified in Section ….. shall not be required at each elevator hoistway 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. **[need language possibly to be consistent]**

Reason: Provisions are necessary to clarify that opening protection at the hoistway opening is not necessary when an elevator lobby is provided. A lobby protects the hoistway from smoke migration therefore the hoistway is already protection. In addition the shaft walls provide sufficient smoke and draft protection to allow the smoke barriers to terminate at those walls.

PROPOSAL 5

AREA OF REFUGE CORRELATION

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 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*.

Reason: This section currently requires that when an elevator lobby is used as an area of refuge that the lobby and the hoistway be protected as a smokeproof enclosure. It was felt that the requirements should be consistent with the lobby construction requirements of Section 3007 and 3008 which are more specifically designed for elevators. By simply using the language for smoke barriers in the existing language the separation requirements for FSAE's and Occupant evacuation elevators is obtained. Additionally, these provisions serve a similar intent to protect occupants while waiting to either self evacuate or be rescued. The smokeproof enclosure requirements are intended for interior exit stairways and would be difficult to apply to an elevator lobby. In addition, the smokeproof enclosure requirements would allow the use of the pressurization option for stairways which was not intended for elevators. Pressurization of elevator hoistways is more appropriately addressed by Section 909.21.

Proposal 6

Corridor Smoke and Draft assembly requirements

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 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: This proposal is intended to clarify that when an 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. 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.

> **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.

Proposal 7

Terminology for elevator lobbies

Add new definitions as follows:

ELEVATOR LOBBY, ENCLOSED. A space created with fire-resistance rated construction to protect the elevator hoistway opening from smoke.

ELEVATOR LOBBY, UNENCLOSED. A space in front of the elevator hoistway opening where occupants exit or enter an elevator that is not separated from the rest of the floor.

Reason: There is often confusion with the term lobby versus elevator lobby . This provides specific definitions for an elevator lobby and also clarifies that lobbies can be open or enclosed. Often the term elevator lobby is used to simply describe the place where people enter or exit a lobby and is not necessarily an enclosed space.

Proposal 8

Links to 3008 and 3007

713.14.1.1 Areas of refuge. Where an area of refuge is required and an enclosed elevator lobby is serving as an areas of refuge the enclosed lobby shall be provided in accordance with ~~as required in~~ Section 1007.

713.14.1.2 Fire Service Access Elevators. Where FSAEs are provided, enclosed elevator lobbies shall be provided in accordance with Section 3007.

713.14.1.3 Occupant Evacuation Elevators. Where occupant evacuation elevators are provided, enclosed elevator lobbies shall be provided in accordance with Section 3008.

Reason. This proposal simply provides clarification as to where all the enclosed elevator lobby requirements are located in other portions of the code. Section 713.14.1.1 was revised to be consistent in approach to the new Sections 713.14.1.2 and 713.14.1.3.

Attachment E

Options for Pressurization of Elevator Hoistways and Elevator Lobbies

ICC Code Technology Committee – Elevator Lobby Study Group

Subgroup: 4.4: Construction: Pressurization of Hoistways and/or Lobbies

Chair: Dave Collins, Members: Jon Siu, Bill Ziegart and Kim Clawson

A Working Draft for Discussion and Revision Updated: January 20, 2011

CONTENTS

1. INTRODUCTION

The potential smoke movement through elevator hoistways during a fire event has been a concern that has been studied for several decades. It is a complicated issue that is impacted by many factors, including building configuration, hoistway height, air temperature conditions inside and outside of the building, HVAC systems design and operations; and interaction with other fire protection systems such as stairwell pressurization, and human behavior.

This document is intended to be a working paper that is modified by the thoughtful input of all interested study group members. It is intended to record the advantages and disadvantages of the major concepts or strategies for minimizing or preventing the movement of smoke through elevator hoistways. **The purpose of this document is to identify essential concepts that are worthy of further investigation, with the ultimate intent of clearly identifying a number of options that can be incorporated into updated versions of the *International Building Code* (IBC).**

This document is in two parts. **The first part summarizes the problems** that can occur with hoistways and related construction. It is essential to understand the nature, risks, extent, probability, and potential costs of all potential problems prior to confirming proposed solutions. **The second part lists potential options** for hoistway configurations, and identifies potential the advantages and disadvantages related to each option. **Once the study group has reached consensus on the content of these two parts, the third step is to use the options as the basis of drafting proposed text for updating the IBC.**

The intent is to review the issue mitigation of smoke movement through elevator hoistways from first principles. What is the science that impacts the movement of smoke for the various options under review, how do building occupants interface with the various options under review, and how does the fire service interface with the various options.

One of the great challenges of building codes is to provide solutions to potential life safety risks or problems, in a manner that is flexible enough to accommodate the multitude of conditions that can occur in the design of buildings of all types; and to also do so in a manner that is truly cost effective. High rise buildings have a multitude of uses, including office, residential (including housing for the elderly), hotel, retail, educational (including classrooms, dorms and academic and administrative offices), healthcare (hospitals), judicial (courtrooms), parking, and detention (prisons). It is not uncommon for high rise buildings to have mixed use occupancies of an assortment of some of the preceding uses. Atriums, garage levels, and other architectural features can further complicate system performance. Therefore, it is important to realize the value of providing an assortment of options for the design team to work with, so the best overall solution can be provided.

Evaluation of all options is team effort, and requires thoughtful consideration from many areas of professional knowledge, including HVAC design and operation (particular smoke management), human behavior and egress, elevator operations, fire services (including fire attack and occupant management), fire detection, alarm and suppression systems, and building owner/tenant management issues.

2. POTENTIAL PROBLEMS COMMON TO HOISTWAYS

There are several problems that are common to two or more options of hoistway configurations. These are summarized as follows, and are not listed in any particular order at this time.

2.1 Building Configuration

The ability to achieve both specified minimum and maximum across door pressure differences is highly dependent on the building geometry and configuration. It may not be possible to meet all pressure requirements without a path for the large hoistway pressurization air flows to exit the building on any potential recall floor; for example open exterior doors or automatically opening vents. The presence of open garage levels, presence or absence of enclosed lobbies, atriums, etc all impact the potential for successful operation of hoistway pressurization systems.

2.2 Need for Dynamic Pressurization

Fan flow requirements can change significantly during the course of operations. The fan speeds required to obtain proper pressure minimums vary significantly with effects such as the opening and closing of doors, the ambient temperature, as well as wind and other related conditions. In general, existing pressurization systems use fixed flow rate fans and cannot adjust to these variations in requirements.

2.3 Interaction of Pressurization Systems

Elevator pressurization requires significantly larger fan flow rates than those of stairwell pressurization systems due to the larger leakages of elevator doorways and the requirement that elevator doors be in the open position (on the recall floor). As such, these large air flows moving throughout the building have the potential to negatively interact with other building operations. For example, across stairwell door pressures can be affected and, in general, stairwell pressurization requirements will be increased when used in conjunction with elevator pressurization. Elevator pressurization also has the potential to cause excessively large pressures across residential doorways, other interior pressure barriers, as well as roof level access points.

As building height increases the potential difficulties in maintaining pressurization within the required limits also increase. Accessibility regulations (such as the *Americans with Disabilities Act* and ICC/ANSI Standard 117.1 *Accessible and Usable Buildings and Facilities*) do not identify the allowable opening force for fire doors, but do indicate that fire doors shall have a minimum opening force allowable by the appropriate administrative authority. For interior hinged doors that are not fire doors, accessibility regulations require the minimum is 5 pounds (22.2 N) maximum. If stairwells are utilized as areas of rescue assistance, consideration needs to be given to what are the appropriate limits for the population type that will generally be occupying a specific building.

Most studies of pressurization of elevator hoistways have been based on the current code practice of elevators recalling to the ground (or other designated) floor, and all hoistway doors being closed, except for those at the recall floor. That scenario would not be applicable for buildings that utilize elevators for occupant evacuation. The impact on a pressurization system from the opening and closing of elevator doors at various levels as part of the elevator evacuation process would need to be studied for a specific building.

2.4 Stack Effect

Because of stack effect, it can be difficult to maintain the code required maximum and minimum air pressures at elevator doors. The problem increases in proportion to the increase in height of a hoistway, and can be greatly impacted by indoor and outdoor air temperature. However, this problem is reduced for elevator pressurization systems in comparison to stairwell pressurization systems. Hoistways require substantially larger external air flow rates than stairwells. As such, hoistway temperatures are nearer to the ambient temperature; thereby reducing the impact of the stack effect.

2.5 Elevator Door Closing

Awareness of the problems with elevator doors not closing due to great differences in air pressure within the hoistway and elsewhere in a building are well known (including acknowledgement in the NFPA *Fire Protection Handbook*), but are perhaps not well understood, or at least not fully accommodated in many building designs. Stack effect and intentional hoistway pressurization can be the cause of this problem.

2.6 Failure or Inadequate Operation of Infrequently Used Systems

If a system is required for use as part of typical operations, problems with operation of that system will be noticed and presumably corrected in a reasonably timely manner. If a system is only used during a rare or an emergency event, any problems of operation with that system that develop over time may not be noticed, unless the system is checked and fully tested on a regular basis. This is an action that depends on human behavior. The effectiveness of regular testing is dependant upon the knowledge and understanding of the how the system should operate during an emergency event; and the ability of those performing the tests to easily and regularly access all components of that system. This needs to be considered in the design of any mechanically pressurization system.

2.7 Air Pressure Increases Due to Elevator Door Closing

A significant amount of air escapes from a pressured hoistway through the elevator doors, even when the doors are in a closed position. When the doors open, that amount of air loss increases significantly. Current codes require that elevator pressurization systems be calibrated with the elevator doors in the open position at the floor of recall. Requirements do not include calibration with elevator doors open at other levels.

With an increased interest in using elevators for occupant evacuation, the amount of door closing time that will occur during an emergency event will become significantly greater. If a system is calibrated with the elevator doors open and then the doors are closed, a substantial increase in air pressure will occur across all elevator doors on all floors. This could potentially result in improper operation of elevator doors (see Section 2.2).

2.8 Air Pressure Losses Due to Code Requirement to Provide Venting at the Top of a Hoistway

Code requirements provide venting at the top of hoistway during a smoke or fire event. This provides another outlet for the movement air from the hoistway. Exemption of that requirement is appropriate when a hoistway is pressurized in a manner that protects the elevator machine room from extreme heat and from smoke. Otherwise the volume of air lost through the vent must be replaced by the mechanical system utilized to pressurize a hoistway,

2.9 Inefficient Use of Floor Air

If the shaft space used for pressurization is only utilized for that purpose, then it becomes a very expensive and inefficient solution to the problem. A more effective approach is when pressurization needs can be provided by smaller ductwork and shaft areas that are part of the normal operations of the building. Noise from air movement through ductwork should be ignored in the design of any HVAC system when it is operating in pressurization mode.

2.10 Recent Development: The Use of Elevators for Occupant Evacuation

Recent code changes and forthcoming changes to the ASME A17.1 *Standard for Elevators and Escalators*, will accommodate the use of elevators for occupant evacuation. Within the 2009 edition of the IBC, buildings utilizing elevators for occupant evacuation are required to provide floor area to accommodate 25% of the occupants of a floor, plus one wheelchair space for every 50 occupants (or fraction thereof) of the floor. Adequate ventilation to occupants waiting for a significant amount of time for evacuation by elevator should be provided in all such designs that utilize elevators for occupant evacuation.

2.11 Recent Development: Return Air at the Perimeter (Exterior Wall) of Buildings

Within a building, the impact of outdoor temperature is obviously most apparent at the inside face of the exterior walls. During the 20th Century the approach was to mitigate the temperature difference by tempering the air at the building perimeter. This meant supplying warm air or cooled air along perimeter of the building, particularly at areas of the exterior wall which have large surface areas of glass.

Within the past decade, with an increase in concern for the design of sustainable buildings, including increased HVAC system efficiency, there has been explorations in changing that approach. There is increased interest in building system designs that provide the return air at the perimeter of the building, and thereby immediately extract into the return air system, the very cool or very warm air adjacent to the building perimeter. Any pressurization strategy should be considered within the performance characteristics of overall ventilation system, including these two basic approaches.

3. OPTIONS

See five page document: "*Summary of Options: Pressurization of Lobbies and Hoistways*" (dated Janaury 20, 2011) for current options under consideration.

4. BRIEF COMMENTS OF OPTIONS

In addition to the advantages and Disadvantages identified in the "*Summary of Options*" document, the follow is noted:

Option A: Basic System: Open Lobby

No pressurization to lobby or hoistway.

Option B: Basic System with Enclosed Lobby

No pressurization to lobby or to hoistway.

Option C: Pressurized Hoistway with Open Lobby

Option D: Pressurized Hoistway with Enclosed Lobby

Option E: Pressurized Lobby

Enclosed lobby but hoistway not pressurized.

Option F: "Push-Pull"

Positive plus negative pressurization with open lobby (but could have an enclosed lobby as a variation.

Option G: Zoned Smoke Control (Pressure Sandwich)

Essentially as described in the "*SFPE Handbook of Fire Protection Engineering* (3rd Edition) Chapter 4-12, and as contained in the 2009 edition of the *Seattle Building Code*.

[End]