Won-Door FireGuard Applications

A Code Analysis
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A Code Analysis

THE INTERNATIONAL BUILDING CODE is widely recognized in the United States as a uniform national building code. It represents the collaborative work by the three previous regional code groups – The International Conference of Building Officials (UBC), The Southern Building Code Congress International (SBCCI) and the Building Officials and Code Administrators (BOCA). Since its initial publication in 2000 it has become the most widely used building code in the United States. The IBC is a model code requiring formal adoption by the local jurisdiction. The 2006 edition of the IBC is the basis for the references in this document.

THE INTERNATIONAL CODE COUNCIL is the official governing body that produces the IBC. This not-for-profit organization represents the coalition of the aforementioned regional building codes. The IBC is only one of a number of different documents published by the ICC. And while the ICC is not a government organization, voting members consist of building officials who are responsible for adopting code changes that appear in each new publication that occurs in three-year cycles. ICC ES (Evaluation Service) is a separate research division of ICC and is responsible for the publication of research reports intended to certify product compliance to the building code. A copy of ICC ES Report ESR-1394 is included in the reference section of this document.
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Definitions

FIRE WALLS – Section 705
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FIRE WALLS – Section 705

Definition
A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. (702)

Fire Ratings: (Table 705.4)
2-hour
3-hour
4-hour

Opening Protection: (705.8)
Non-sprinklered buildings – Openings shall not exceed 120 square feet and the aggregate width of openings shall not exceed 25 percent of the length of the wall.
Sprinklered buildings – Openings may exceed 120 square feet but the aggregate width of all openings shall not exceed 25 percent of the length of the wall.

Design notes
- Each portion of a building separated by one or more fire walls shall be considered a separate building. (705.1)
- Where a fire wall separates occupancies that are required to be separated by a fire barrier wall, the most restrictive requirements of each separation shall apply. (705.1)
- Regardless of the rating of the opening protective, fire walls cannot have openings that exceed 25 percent of the length of the wall.
- Fire walls constructed as party walls shall NOT have openings. (705.1.1)

Applications
- Exceeding area allowances (Table 503)
- Horizontal Exits (1022)
- Means of Egress (1008.1.2 Exception #6)
FIRE BARRIERS – Section 706

Definition
A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained. (702)

Fire Ratings: (Table 706.3.9)
- 1-hour
- 2-hour
- 3-hour
- 4-hour

Opening Protection
Non-Sprinklered Buildings – Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and the maximum area of any single opening shall not exceed 156 square feet. (706.7)

Sprinklered Buildings – Openings may exceed 156 square feet but must be limited to a maximum aggregate width of 25 percent of the length of the wall, unless the opening protective assembly has been tested in accordance with ASTM E119 and has a minimum fire-resistance rating not less than the fire-resistance rating of the wall. (706.7 Exceptions 1 & 3).

Design Notes
- A fire barrier may have an opening exceed the 25% rule if the building is sprinklered and the opening protective assembly is the Won-Door Moveable Fire Wall (MFW, ASTM E-119), in lieu of the Won-Door FireGuard Door Assembly.

Applications
- Shaft Enclosures (707.4)
- Exit Enclosures (1020.1)
- Exit Passageways (1021.1)
- Horizontal Exits (1022.1)
- Atriums (404.5)
- Incidental Use Areas (508.2)
- Control Areas (414.2.3)
- Separation of Mixed Occupancies (Table 508.3.3)
- Single-Occupancy Fire Areas (Table 706.3.9)
**FIRE PARTITIONS** - Section 708

**Definition**
A vertical assembly of materials designed to restrict the spread of fire in which openings are protected. (702)

**Fire Ratings** (708.3)
1-hour

**Opening Protection**
Opening protectives in fire partitions shall have a minimum fire rating of 20 minutes and a maximum of 45 minutes (Table 715.4) and shall be smoke tested under UL 1784.

**Design Notes**
- Most rated corridor walls fall into this category. (708.1.4 and Table 1017.1)
- Corridor walls in an I-2 Occupancy (Hospital) shall be constructed as Smoke Partitions. (407.3 & 710)

**Applications**
- Walls separating dwelling units in the same building. (708.1)
- Walls separating sleeping units in occupancies in Group R-1 Hotel, R-2 and I1 Occupancies. (708.1)
- Walls separating tenant spaces in covered mall buildings as required by Section 402.7.2. (708.1)
- Corridor walls as required by Section 1017.1. (708.1)
- Elevator lobby separation as required by Section 707.14.1. (708.1)
- Residential aircraft hangers. (708.1)
**SMOKE BARRIERS** – Section 709

**Definition**
A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly that is designed and constructed to restrict the movement of smoke. (702)

**Fire Ratings** (709.3)
1-hour

**Opening Protection**
Opening protective in smoke barriers shall have a minimum 20 minute fire rating and UL 1784 smoke tested. (Table 715.4)

**Design Notes**
- Door assemblies in smoke barriers of I-2 Occupancies (Hospitals) shall have vision panels. (709.5)
- Smoke barriers constructed of minimum 0.10-inch-thick steel in I-3 Occupancies (Jails & Prisons) are not required to be 1-hour rated. (709.3)

**Applications**
In I-2 Occupancies (Hospitals) smoke barriers are required to subdivide every story used by patients for sleeping or treatment. (407.4) As per the following:
- 50 or more persons / minimum 2 smoke compartments
- Each compartment cannot exceed 22,500 square feet
- Travel distance shall not exceed 200 feet to a smoke barrier door

In I-3 Occupancies (Jails & Prisons) smoke barriers are required to divide every story occupied by residents for sleeping. (408.6) As per the following:
- 50 or more persons / minimum 2 smoke compartments
- Maximum number of residents in any smoke compartment is 200
- Travel distance to any exit access component shall not exceed 150 feet
- Travel distance to any smoke barrier door shall not exceed 200 feet
**SMOKE PARTITIONS** - Section 710

**Definition**
A partition constructed to limit the transfer or passage of smoke. (710.4)

**Fire Ratings** (710.3)
Non-rated

**Opening Protection**
Door assemblies shall be UL 1784 tested and self closing by smoke detection. (710.5)

**Design Notes**
- Smoke partitions and their use lack clarity in the building code. Although it is not specifically referenced, smoke compartmentation can be accomplished with non-rated smoke partitions.

**Applications**
- Corridor walls of I-2 Occupancies (Hospitals). (407.3)
- Elevator Lobbies (707.14.1 Exception #5)
Area Separation

Area Allowance
Area Allowance
Section 705; Table 503

Buildings are subject to height and area limitations. Should a building design exceed an area limitation the intent of the code is to create another separate building to incorporate the increase. Since this is not always desirable the code will allow interior fire walls to serve as separations creating multiple buildings within the same structure.

Fire & Life Safety Concerns
Exterior walls that separate buildings from each other afford maximum protection from fire traversing structures. Therefore, fire walls used to create separate buildings within a single structure must provide the same level of structural integrity and independence that is afforded by an exterior wall. A fire on either side of the fire wall may cause building collapse, however, the wall itself cannot collapse.

Another concern is the size of openings allowed in a fire wall. Opening size limitations are imposed to maintain the fire-resistant integrity of the wall during fire conditions. Note that a fire wall used for area separation is allowed openings and opening protectives, however, a fire wall used as a party wall cannot have openings.

Code Requirements
1. Table 503 of Chapter 5 indicates the tabular height and area allowances for specific building occupancies and types. Please note, the more combustible the construction type the lesser the area allowance. Conversely, the greater the non-combustible elements the greater the area allowance, even to the extent of unlimited area in Type IA construction. However, non-combustible construction is significantly more costly than combustible construction.

2. Openings within fire walls are subject to the following criteria (705.8):
   - Non-sprinklered buildings – Openings shall not exceed 120 square feet and the aggregate width of openings shall not exceed 25 percent of the length of the wall.
   - Sprinklered buildings – Openings may exceed 120 square feet but the aggregate width of all openings shall not exceed 25 percent of the length of the wall.

Design Solution
In this case study the multi-plex theater facility was to be designed as a Type IIIIB structure in order to save money. However because of the quantity of theaters the total
area of the structure exceeded the allowable area values in Table 503 for Type IIIB construction. The owner was left to accept a significant cost-of-construction increase by moving forward with Type IIB construction to accommodate the increased area.

At first look the alternative to incorporate two fire walls creating three separate buildings in order to sustain Type IIIB construction was certainly attractive on the cost ledger sheet. But an aesthetic concern arose over openings in the fire walls being limited to swing doors in the large occupant load communicating areas. Because of the unlimited width fire door listing of the Won-Door FireGuard assembly these openings were expanded wall to wall only to close in case of fire and neither the design nor code requirements were compromised.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   1. 2006 IBC Section 1008.1.2, Exception #6
   2. 2006 Section 1008.1.3.3 (Compliance Criteria)
   3. 2006 NFPA 101, 7.2.1.4.1.5
   4. 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)
Inquiry Discussion & Questions

Whether or not to use the area separation strategy is determined early in the conceptual design phase of the project.

Resistance to incorporate fire walls may be due to the following:

- Limited understanding of the code allowances for considering one structure as multiple buildings.
- The structural integrity of the fire wall design appears costly and overwhelming compared to the basic design, i.e. parapets, return exterior walls, etc.
- Limited understanding of opening protectives. When the designer approaches opening these walls with swing doors or roll-downs there is a feeling of closed and limited space ambiance.
- Limited knowledge regarding the cost differential between construction types. Many times, to avoid the above issues, the design will move to a more non-combustible construction type incurring significant additional cost and minimizing if not eliminating separation issues.

The following questions may be helpful:

- Have you ever been frustrated designing a structure because you exceeded the area allowances and were pushed to increase the construction type?
- When you are required to change a construction type to accommodate additional area, what is the increase in cost? How does your client feel about the increase?
- Are you hesitant to consider an area separation wall because of the limitations for openings as implied with conventional swing or roll-down doors?

Notes:

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Occupancy Separation

Fundamental Guidelines

Mixed Occupancy – Accessory Use

Mixed Occupancy Use – Non-Separated vs Separated
Fundamental Guidelines
Table 508.3.3

Most buildings are designed for multiple uses that will typically result in more than one occupancy classification. The code provides three basic options for mixed occupancies in Section 508.3:

1. **Accessory occupancies:** Section 508.3.1
2. **Nonseparated occupancies:** Section 508.3.2
3. **Separated occupancies:** Section 508.3.3 & Table 508.3.3

Chapter 3 of the building code specifically classifies a building according to its use and occupancy. The level of fire hazard varies with specific uses and occupancies in a building. However, this level of hazard and its potential affect on the building occupants is determined not only by the use and occupancy classification but by construction type, height and area size, as well as the use of passive and active fire protection systems. Chapter 5 combines fire-resistance levels, construction types and occupancy types to determine size and height limitations as well as separation requirements.

Increased fire resistance of the structural members of the building along with increased active and passive fire protection systems allows for greater height and area allowances as well as increased building occupant protection. For example, office buildings are typically ambulatory with low occupant loads whereas hospitals are non-ambulatory with increased occupant loads. The fire and life safety requirements designed to protect building occupants are very different for each of these occupancies. Therefore, when buildings are designed as mixed occupancies there is a concern because basic fire and life safety requirements are being mixed within the same structure. Three basic options to eliminate confusion and ensure building occupant safety are outlined below:

**Accessory Occupancy:**

1. Accessory occupancies are those subsidiary to the main occupancy or portion thereof. (508.3.1)
2. Aggregate accessory occupancies shall not occupy more than 10% of the area of the story. (508.3.1)
3. Aggregate accessory occupancies shall not exceed the tabular values in Table 503 without height and area increases. (508.3.1)
   - Exception #1 – Less than 750 square feet are not considered separate occupancies.
   - Exception #2 – Assembly accessory areas in Group E (schools) are not considered separate.

**Non-Separated Use:**

To consider spaces under the Non-Separated use the following requirements must be met allowing NO separation between occupancies:

1. Each use shall be individually classified. (508.3.2.1)
2. Code requirements shall apply to each portion of the building based upon the occupancy classification of that space. (508.3.2.1)
3. The most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the entire building or portion thereof. (508.3.2.1)

4. The allowable area and height of the building or portion thereof shall be based on the MOST RESTRICTIVE allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1. (508.3.2.2)

**Separated Use:**

The following requirements under the provisions of Separated Occupancies will bring these spaces into compliance without compromising design if separated with fire barrier walls according to Table 508.3.3:

1. Separated occupancies shall be classified in accordance with Section 302.1. (508.3.3.1)

2. Each fire area shall comply with the code based on the occupancy classification of that portion of the building. (508.3.3.1)

3. In each story, the building area shall be such that the sum of the ratios of the actual floor area of each occupancy divided by the allowable area of each occupancy shall not exceed one. (508.3.3.2)

4. Height allowances shall also comply with limitations based on type of construction of the building in accordance with 503.1. This height requirement is limited to the fire area created at each floor. (508.3.3.3)
Mixed Occupancy – Accessory Use
Section 508.3.1

Schools consistently incorporate mixed occupancies. The code is very liberal with the separation of accessory use spaces, particularly those that are classified as assembly use. However not all mixed occupancies in schools are assembly use.

Fire & Life Safety Concerns
Full service kitchens in schools pose a fire and life safety threat due to the use of open flame, combustible gases and solids which require exhaust hood extinguishing systems. These kitchens are considered as “B” (Business) occupancies in lieu of “A” (Assembly) occupancies.

Code Requirements
Table 508.3.3 is designed to mitigate potential hazards passing between occupancies by detailing occupancy separation requirements. These requirements are categorized by occupancy type and fire barrier wall fire-ratings in sprinklered and non-sprinklered buildings. A 1-hour fire barrier is required to separate an E (school) occupancy from a B (business) occupancy within the same structure (Table 508.3.3).

Design Solution
Section 508.3.1 explains that accessory occupancies are subsidiary to the main occupancy of the building and can be considered without separation if they do not occupy more than 10% of the area of the story they are located.

In this case study the kitchen area exceeds this limitation and therefore must be separated. In order to
allow full access by students to the serving area and ensure ease of traffic flow a wide-span Won-Door FireGuard became the solution. This assembly, to close only in case of fire, allowed a large opening in a 1-hour wall without compromising the code requirements or the design.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   1. 2006 IBC Section 1008.1.2, Exception #6
   2. 2006 Section 1008.1.3.3 (Compliance Criteria)
   3. 2006 NFPA 101, 7.2.1.4.1.5
   4. 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

Inquiry Discussion and Questions

The purpose of this case study is to examine a somewhat questionable issue in the IBC. Most State jurisdictions with responsibility for schools have considered full-service kitchens to be accessory spaces under the assumption that kitchens are occupancy type A (Assembly) areas. It is clearly stated in 508.3.1, Exception #2 that Assembly areas accessory to Group E occupancies are not considered separate occupancies.

However, building officials from all areas of the country are in agreement that kitchens, which are not listed anywhere in Chapter 3 with a classification, are in fact B occupancies. If a kitchen is considered a B occupancy then Exception #2 does not apply and this space must be separated from the rest of the building (Table 508.3.3).

The following questions may be helpful:

- What is the occupancy classification of a full service kitchen within an occupancy Type E structure?
- Do you perceive a full service kitchen that requires a Type I exhaust hood extinguishing systems as per the International Fire Code (Section 610.2 & IBC 904.2.1)) a potential threat to the students?
- When you are required to separate the kitchen from the rest of the space are you concerned about easy access and traffic flow in front of the serving area?
- Would it be more convenient for your client to have the opening protective located in front of the serving area to act as a security door when the kitchen is not in use?

Notes:

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Occupancy Separation | Mixed Occupancy – Accessory Use
Mixed Occupancy Use – Non-Separated vs Separated

Section 508.3.3

Complying with Table 508.3.3 and providing fire barrier walls to separate occupancies is extremely limiting to the design. Also, using non-separated provisions to eliminate restrictive fire barrier walls becomes extremely costly due to added fire and life safety requirements that affect the entire structure.

Fire & Life Safety Concerns

Building structures are classified based on their occupancy and use. The purpose for classifying structures is to configure optimum safety requirements commensurate to the need as dictated by each individual use. These areas of concern are general building limitations, means of egress, fire protection systems and interior finishes. The challenge comes when buildings contain rooms or spaces that are different than the original building occupancy classification thereby creating a mixed use or mixed occupancy structure.

Table 508.3.3 is designed to mitigate potential hazards passing between occupancies by detailing occupancy separation requirements.

Code Requirements

In this case study the Conference/Training Room is 1,188 Square Feet with an occupant load of 79. It is classified as an A-3 occupancy located in a 5-story Group B office building of Type IIIB construction. The conference room is classified as an A-3 because it is used for gathering a large number of people for assembly purposes (Section 303.1). It cannot be considered an accessory space because it exceeds both occupant load and area square footage of the accessory use exceptions.

First let’s look at the requirements imposed if we attempt to eliminate all separations called for from Table 508.3.3, in other words non-separated use.

Non-Separated Use:

To consider this space under the non-separated use the following must be met requiring NO separation between occupancies:

1. Each use shall be individually classified. (508.3.2.1)
   - The entire building is classified as a “B” occupancy. The space under consideration (Conference/Training Room) is an A-3 occupancy.

2. Code requirements shall apply to each portion of the building based upon the occupancy classification of that space. (508.3.2.1)
   - The requirements referred to are those involving exiting, travel distance, occupant load driven issues, etc. The requirement imposes different rules for different occupancies.

3. The most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the entire building or portion thereof. (508.3.2.1)
   - Section 403 encompasses the requirements for hi-rise construction and Chapter 9

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includes the provisions for fire protection systems. In other words the building will have to incorporate the most protective and restrictive requirements of these chapters. For example:

1. Standpipe system (905)
2. Fire Alarm & Detection Systems (403.5; 907).
3. Emergency voice/alarm communication systems (403.6)
4. Fire Department communications system (403.7).
5. Fire command (403.8).
6. Standby power (403.10).

4. The allowable area and height of the building or portion thereof shall be based on the MOST RESTRICTIVE allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1. (508.3.2.2)
   * The height and area allowances for this requirement would not allow the building to be five stories. Most likely only three at best.

**Design Solution**

In this case study the most equitable alternative would be to provide occupancy separation at the conference/training room area separating the A-3 from the B occupancy. With the Won-Door FireGuard we are not limited to a pair of conventional swing doors as an opening protective. Also, the design can accommodate 5 stories and remain a Type IIIB building eliminating the need for all of the most restrictive provision of Section 403 and Chapter 9.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   • 2006 IBC Section 1008.1.2, Exception #6
   • 2006 Section 1008.1.3.3 (Compliance Criteria)
   • 2006 NFPA 101, 7.2.1.4.1.5
   • 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

**Inquiry Discussion & Questions**

Fundamentally, separating buildings with fire barriers wherever occupancies change as required in Table 508.3.3 is simple and straightforward. However when designs promote mixed occupancies without separations the code is left to create alternate means of protection to compensate for the loss of fixed barriers. Hence, enforcing the requirements as indicated above by imposing additional active systems becomes subjective at best. This kind of mysterious and costly code implementation is easily avoided by simply separating occupancies where required.

The following questions may be helpful:

- Are you frustrated because open design is difficult when incorporating fire barrier walls as occupancy separations?
- Can I show you how wide span opening protective can eliminate the need to design non-separated structures?
- Have you considered the additional cost incurred by conforming to the non-separated occupancy requirements?
- Do you really want to impose the most restrictive requirements of Chapter 4, Section 403 hi-rise provisions as well as the most restrictive requirements of Chapter 9 to the entire building?

**Notes:**

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Vertical Opening Separation

Fundamental Guidelines
Non-Egress Stairs
Shaft Enclosure – Escalator
Atriums
Vertical Exit Enclosures
Fundamental Guidelines

Section 707 & 1020

Vertical openings between floors are designed consistently in multi-story buildings in many different shapes, heights and uses. For the purposes of code enforcement the following general categories are described in the building code:

1. Shaft enclosures (707)
   a. Escalators (707.2, Exception #2)
   b. Mezzanines (707.2, Exception #9)
   c. Stairs or ramps (707, 1020)
   d. Elevators & dumbwaiters (707.14)
2. Atriums (404)
3. Vertical Exit Enclosures (Section 1020)
4. Non-egress and/or communicating stairs (707.2, Exception #11 & 1020.1, Exception #4, #8 & #9)

Usually anytime two or more floors are open to each other a vertical opening is created and the phrase “floors are common with each other” is used to characterize the condition.

Two tightly interwoven fundamental principles drive the requirements of vertical opening protection. First, the migration of smoke, heat and toxic gases floor to floor. Second, egress of building occupants from upper levels to a safe level of exit discharge.

The case studies in this section illustrate the balance between these two principles in the enforcement of fire & life safety provisions for building occupants in multi-story buildings.
Non-Egress Stairs
Section 707.2

This case study deals with a condition wherein three floors are common to each other. At least two of the floors are inter-connected with a non-egress communicating stair. Non-egress means – the communicating/convenience stair may not be considered as a required means of egress from any space.

Fire & Life Safety Concerns
Multiple floors open to each other is perhaps one of the most serious fire danger threats in any multi-story building. Fire suppression is concerned with confining a fire to the floor of origin and preventing the fire or the products of the fire (smoke, heat and hot/toxic gases) from spreading to other levels. The code is structured to accomplish this task.

Code Requirements
The code references listed below will address the allowance of two floors common under permitted conditions:

1. A shaft enclosure is not required for floor openings created by unenclosed stairs in accordance with Exception #8 or #9 of Section 1020.1. (707.2, Exception #11)

2. In other than Group H and I occupancies, interior egress stairs serving only the first and second stories of a building equipped throughout with an automatic sprinkler system . . . are not required to be enclosed as long as at least two means of egress are provided from both floors served by the unenclosed stairways. (1020.1, Exception #9)

3. Any two such interconnected floors shall not be open to other floors. (1020.1, Exception #9)
Design Solution

Since this space contains a stair and the additional required exits are in place, the 109-foot bi-parting Won-Door assembly was placed on the third floor successfully separating the remaining two interconnected floors, only in case of fire. With the wide-span capabilities of the Won-Door FireGuard assembly there is no compromise with building function ability and code compliance.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)
Inquiry Discussion & Questions

In essence, this application does not fall under the atrium requirements, nor is it required to create a full height shaft enclosure even though two floors are common, because there is a stair communicating the two floors and there is adequate required exiting from the unenclosed stair. Also, the third floor is separated away allowing the two-floors-common Exceptions to apply.

Why can this be considered a shaft in lieu of an atrium? Section 404.1.1 defines an atrium as “An opening connecting two or more stories OTHER THAN ENCLOSED STAIRWAYS ... ”

In this case we are going to defer this space to the enclosed stairway provisions in Section 707.2 to avoid the atrium requirements. Section 707.2, Exception #11 allows elimination of the shaft enclosure in openings created by unenclosed stairs or ramps in accordance with Exception 8 or 9 in Section 1020.1.

The following questions may be helpful:

- Do you have clients who wish to occupy multiple floors with a vertical common area connecting all floors?
- Can I show you how interconnecting unenclosed stairs can be incorporated into the design without creating shaft enclosures or complying with atrium requirements?
- Have you been frustrated attempting vertical space separation without the closed-in shaft appearance?
- Did you know I can offer you a wide-span opening protective to separate vertical spaces that can also serve as the required exit from unenclosed stairways?

Notes:
Shaft Enclosures – Escalator
Section 707.2

An escalator provides convenient movement for building occupants traversing multiple floors. However, escalators are typically not a part of the required means of egress.

Fire & Life Safety Concerns
Openings through floors allow fire – or the products of fire (smoke, heat and hot toxic gases) – to spread to other floors. There is a particular need to protect this area since building occupants can be riding/standing on escalators during a fire. There is also the need to allow for egress from this space when it is sufficiently protected. Notwithstanding minor exceptions, protecting escalator openings is listed under shaft enclosure requirements because the intent is to create a sealed shaft in case of fire.

Code Requirements
The following exceptions are allowed in lieu of creating a shaft, however, they are very difficult and expensive to accomplish:

Escalators must be enclosed unless the design meets the following requirements: (707.2 Exceptions 2.2.1 & 2.2.2)

First, an automatic sprinkler system must be installed throughout the entire building and, secondly, an escalator must NOT be a portion of the means of egress system. If both of these issues are satisfied then the following criteria must also be met:

1. The floor opening between stories does not exceed twice the horizontal projected area of the escalator or stairway (707.2, Exception 2.2.1).
2. The opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13 (707.2, Exception 2.2.1)
3. In other than Groups B and M, this application is limited to openings that do not connect more than four stories.

Design Solution
The Won-Door FireGuard assembly can easily negotiate radius applications with no restriction on width, and heights to 28 feet. It is much less expensive to enclose the escalators and create a shaft enclosure.
The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

**Inquiry Discussion & Questions**

Escalators in high-profile locations cannot be limited to the design criteria as stated above and maintain the desired ambiance of the space.

The following questions may be helpful:

- Would you like to use the escalator as a required exit?
- Have you considered the cost difference between a shaft enclosure and the open escalator design requirements?
- Have you considered wide-span opening protectives as an alternative to conventional swing or roll-down doors in shaft enclosure walls?
Notes:
Atriums
Section 404

An atrium is a floor opening, or a series of floor openings, that connects the environment of adjacent stories. By definition an atrium is a space within a building that extends vertically and connects two or more stories. Atriums are designed to provide open and spacious vertical areas common with other building elements.

Fire & Life Safety Concerns

Unprotected vertical openings are often cited as the factor responsible for fire spread in incidents involving fire fatalities or extensive property damage. Section 404 addresses the need for protection of these specific building features in lieu of providing a complete floor and/or vertical shaft separation.

Code Requirements

Vertical openings in an atrium are not considered un-protected, rather the atrium is considered a protected space by means other than a shaft enclosure. In other words, compliance with atrium requirements allows an adequate alternative to the fire-resistance rating of a shaft enclosure. Listed below are the specific provisions allowing atriums to be open and spacious:

1. Engineered smoke control system – this system shall be installed in accordance with Section 909. Exception: Smoke control is not required for atriums that connect only two stories. (404.4)
2. An approved sprinkler system installed throughout the entire building. (404.3)
3. Adjacent spaces shall be separated by 1-hour fire barrier construction. (404.5)
   Exception #1 – Glass wall protected so that the entire surface of the glass is wet upon activation.
   Exception #2 – A glass-block wall assembly in accordance with Section 2110 rated at 3/4-hour.
   Exception #3 – The adjacent spaces of any three floors of the atrium shall not be required to be separated from the atrium where such spaces are included in the design of the smoke control system.
4. Smoke control equipment must be connected to a standby power system. (404.6)
5. Interior finishes on all walls and ceilings shall not be less than Class B. (404.7)

6. Other than the lowest level of the atrium, travel distance shall not exceed 200 feet. (404.8)

**Design and Code Compliance**

By using the wide-span opening protective characteristics of the Won-Door FireGuard product a shaft enclosure can be created by separating each floor with fire barrier walls.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)
Inquiry Discussion & Questions

The optimum protection of vertical opening spaces is to create a shaft enclosure. Literally all of the requirements listed above that become a substitute for a shaft enclosure are erased from the design if a shaft is created. The cost savings are phenomenal.

The following questions may be helpful:

- The size of the smoke evacuation system is based upon the calculation of total cubic footage of not only the atrium space but all spaces that open into the atrium space. Can I help you minimize this system cost by reducing the cubic footage with wide-span opening protectives at critical locations in the atrium?
- Have you considered the cost savings if eliminating all of the atrium requirements by creating a fully enclosed shaft in this vertical space?

Notes:
Vertical Exit Enclosures
Section 1020

Exit enclosures extend vertically through the interior of multi-story buildings in order to ensure timely and safe evacuation of occupants during an emergency. These enclosures include exit stairs and exit ramps.

Fire & Life Safety Concerns
Because exit enclosures penetrate horizontal floor and ceiling assemblies, fire, heat, smoke and toxic gases can potentially penetrate into building spaces at each floor level. Therefore, enclosures become critical barriers of protection for building occupants. The protected enclosure will be a non-contaminated exit path for at least one hour in buildings less than four stories and two hours in buildings four stories or more.

Code Requirements
1. Interior exit stairways shall be enclosed with fire barriers in accordance with Section 706. (1020.1)
2. Exit enclosures in buildings connecting four stories or more shall be rated at 2 hours; less than four stories at 1 hour. (1020.1)
3. Openings and penetrations shall be rated in accordance with Section 715. (1020.1.1)

Design Solution
Openings in these rated enclosures are typically limited in size to conventional swing doors. However by using the UL labeled Won-Door FireGuard FG60 or FG90 doors the stair or ramp landing space can easily be open and common with the floor it is serving regardless of the

VERTICAL OPENING SEPARATION
width of the opening and heights up to 28 feet. The Won-Door FireGuard Door can also serve as the only exit from the stair or ramp.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   • 2006 IBC Section 1008.1.2, Exception #6
   • 2006 Section 1008.1.3.3 (Compliance Criteria)
   • 2006 NFPA 101, 7.2.1.4.1.5
   • 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

Inquiry Discussion & Questions

Required exit stairs in vertical shaft enclosures ensure building occupant safe evacuation. Historically the designs of openings at the exit discharge level have been limited to conventional side-hinged swinging doors. The acceptance of the Won-Door FireGuard product as both a wide-span opening protective as well as a complying egress door provides the designer flexibility without compromising code compliance.

The following questions may be helpful:

• Do you find building owners and maintenance groups struggling with door swing and maintenance on door hardware in high-traffic spaces?
• Do you seek an open and spacious appearance at the landing area of vertical stair enclosures?
• Would you like to use a required vertical exit stair shaft as an aesthetically pleasing communicating stair by opening the enclosure area at each floor?

Notes:
Corridor Separation

Corridor Separation – Retail

Corridor Separation – Healthcare
Corridor Separation – Retail
Section 1014.2, Item #2

Large retail stores are typically designed to mix two occupancies under one roof. Usually the largest space is a Group “M” (Mercantile) occupancy for merchandising to the public. The lesser portion is a Group “S” (Storage) occupancy where merchandise is stored.

Normally a 1-hour fire barrier wall is constructed to meet the occupancy separation requirements as well as provide a privacy separation. The challenge comes with compliance to exiting requirements both in exit spacing and exit access through intervening rooms.

Fire & Life Safety Concerns
Stock or storage rooms or spaces that are adjacent mercantile occupancies could be characterized as rapid fire buildup areas. Requiring occupants to pass through these adjoining spaces to satisfy other egress provisions places them in an unreasonable risk situation. The code simply requires these exit paths to be clearly marked and protected to ensure building occupant safety while exiting.

Code Requirements
First, we will review the exit requirements:
1. Required number of exits (Table 1019.1).
2. Exit width (Table 1005.1).
3. Exit spacing – one-third the distance of the diagonal (1015.2.1, Exception #2).

Second, we will review the exit access requirements:
1. CANNOT exit through storage rooms unless compliance with certain provisions are met (1014.2, Item #2, Exception #2).
   2.1 The stock room is of the same hazard classification as found in the main retail area.
   2.2 Not more than 50 percent of the exit access is through the stockroom.
   2.3 The stockroom is not subject to locking from the egress side.
   2.4 There is a demarcated, minimum 44 inch wide aisle defined by full or partial height fixed walls or similar construction that will maintain the required width and lead directly from the retail area to the exit without obstructions.
Design Solution

In this case study we will review the design of a successful retail firm. This group was using solid walls with roll-down door assemblies as opening protectives in the marked and fixed walls designed for exiting during an emergency. The roll-down doors gave them flexibility for openness during normal business hours in the stock room. Due to repair and maintenance costs as well as size limitations they have chosen the Won-Door FireGuard assembly to meet the egress requirement from one occupancy through another to the outside of the building.

The FireGuard complies as an opening protective as well as a conforming exit:
1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   • 2006 IBC Section 1008.1.2, Exception #6
   • 2006 Section 1008.1.3.3 (Compliance Criteria)
   • 2006 NFPA 101, 7.2.1.4.1.5
   • 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

Inquiry Discussion & Questions

Since this code requirement is designed to ensure an unobstructed and full required width exit path to the exterior of the building, the designer must use more than a marked floor to delineate the exit path. This mindset promotes fixed walls that cross high traffic storage areas with conventional swing or roll-down doors. There is a tendency to assume that protected areas for egress must have minimal openings.

There is a need to exit from the stock room space into the fixed wall marked exit path. Some designs incorporate two systems in one wall opening, first a wide roll-down for more open spaces; second, a swing door for exiting purposes from the stock room into the path of exit since the roll-down assembly is not a conforming exit door.

The following questions may be helpful in assisting the designer understand better options:
   • In order to satisfy separation-of-exit requirements in large retail “M” occupancies it is
going to be necessary to exit through the storage areas. Do your clients struggle with excessive repair costs regarding equipment mobility and damage to door jambs, rails and canisters?

• In order to satisfy separation-of-exit requirements in large retail “M” occupancies it is going to be necessary to exit through the storage areas. Do your clients struggle with excessive reset/maintenance costs after conventional door systems have been deployed either accidentally or for testing purposes?

• In order to satisfy separation-of-exit requirements in large retail “M” occupancies it is going to be necessary to exit through the storage areas. Do your clients struggle with limited width and height openings with conventional door systems restricting stock room mobility?

• There is a need to exit from the stock room space into the fixed wall marked exit path. If you are using a non-egress roll-down assembly as the exit path separation it will be necessary to provide an additional conforming exit door. Can I show you how Won-Door can serve both functions at no additional cost?

Notes:
Corridor Separation – Healthcare

Section 407.2.4

Gift shops focus on retail exposure to the public. Nonetheless they are located in hospitals and typically open to corridors that fall under strict provisions for life safety. Compliance with these strict provisions using conventional opening protectives can limit market exposure.

Fire & Life Safety Concerns

The corridor system in a hospital is designed to protect non-ambulatory patients and their attendants from the transfer of heat and smoke from adjacent spaces. Gift shops offer a particular threat due to the potential fuel load created by large quantities of merchandise and paper goods. So it goes, the smaller the shop the lesser the threat of contents that are burning during a fire emergency. Therefore the code requires no separation at the corridor opening of a gift shop if the square footage in minimal.

Code Requirements

Gift shops are allowed to be open to the corridor where the total square footage of the space does not exceed 500 square feet (407.2.4).

To better understand the opening protective requirements let’s review the corridor provisions for I-2 occupancies (hospitals).

1. The corridor wall shall be constructed as a smoke partition (407.3).
2. Smoke partitions are not required to be fire-rated (710.3).
3. Doors protecting openings in smoke partitions in I-2 occupancies are as follows:
   - Non-fire-rated (407.3.1).
   - Not required to be self-closing or automatic-closing (407.3.1).
   - Must be positive latching (407.3.1)
   - Shall provide an effective barrier to limit the transfer of smoke (407.3.1)
   - Must be a smoke and draft control door listed under UL1784 (710.5.2).

Design Solution

In this case study the designer can easily exceed the 500 square foot limitation and still provide the protection needed during a fire as well as the primary means of
egress from the space. Also, this egress technology allows the unlimited width Won-Door FireGuard to be used as the security door during off hours.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

**Inquiry Discussion & Questions**

This space is considered an incidental use area when it exceeds 500 square feet. Most designs will limit this space to 500 square feet or incorporate sheet rock, swing doors and wire glass to accommodate greater area spaces that open to the corridor. Table 508.2 lists other incidental use areas but does not include gift shops in I-2. The issue that drives the gift shop separation requirement is that it opens to a corridor. Incidental use areas that are required to be separated as listed in Table 508.2 may or may not be open to a corridor, regardless, each must be separated. This understanding would open an interesting discussion when attempting to
differentiate between corridor separation spaces and/or incidental use areas. The following questions may be helpful in understanding pertinent challenges:

- Do you desire to have a gift shop larger than 500 square feet?
- Even though a gift shop, larger than 500 square feet, is not shown on Table 508.2 as an incidental use space ... why is it required to be separated with 1-hour construction?
- May I show you how Won-Door can help you eliminate a closed-in appearance at the corridor bordering gift shops exceeding 500 square feet in area?
- Is a waste and linen room required to be separated if it is not located on a corridor? (See Table 508.2)
- Which is the least expensive when separating laboratories or vocational shops; 1-hour separation with wide-span opening protectives or elaborate fire-extinguishing systems in addition to sprinklers? (See Table 508.2)

Notes:
Exit Access Separation

Horizontal Exit
Exit Passageway
Pedestrian Walkways & Tunnels
Horizontal Exit
Section 1022

Horizontal exits are designed to move building occupants on a floor from one fire protected area to another.

Fire & Life Safety Concerns
Fundamentally the horizontal exit differs from the typical code defined exit. The horizontal exit is calculated to “defend in place” by creating an area of safe refuge for building occupants within the confines of the building structure. All other exits are designed to exit occupants out of and away from the building.

Code Requirements
Because building occupants are not being removed from the building when utilizing the horizontal exit, specific precautionary requirements are based upon the following fundamental principles:

Principle #1 – A 2-hour fire wall or fire barrier must be used to separate fire areas connected with a horizontal exit (Section 1022.2). The determination between the use of a fire wall or fire barrier is the function of the wall as it relates to other code requirements.

Principle #2 – The opening within the horizontal exit must be protected with a self-closing or automatic closing fire door when activated by a smoke detector. The fire rating of the door must be a minimum of 90 minutes (Sections 1022.2 & 1022.3).

Principle #3 – A horizontal exit cannot serve as the only exit from the fire area. In cases where two or more exits are required, not more than one-half shall be horizontal exits (1022.2). In order to minimize this requirement the following criteria must be met:

Exception #1: In an I-2 (hospital) occupancy horizontal exits can comprise two-thirds of the required exits (Section 1022.1, Exception #1).

Exception #2: In an 1-3 (prison) occupancy horizontal exits can be the only and primary means of egress from the space (Section 1022.1, Exception #2).

Principle #4 – The capacity of the refuge areas separated by a horizontal exit are calculated based upon the following:

1. The refuge area shall be occupied by the same tenant (Section 1022.4).
2. The refuge area must be large enough to accommodate the original occupant load plus the occupant load anticipated from the adjoining fire area (Section 1022.4).
3. The only exceptions to these rules are in I-2 and I-3 occupancies (1022.4, Exceptions #1 thru 3).

In this particular case study the intent is to add a 9,700 square foot critical care suite on an existing I-2 (hospital). However other code requirements come into play affecting the design dramatically:

• First, suites of sleeping rooms cannot exceed 5000 square feet and in this case a 9,700 square foot suite is being added (1014.2.2.2).
• Second, there must be two exits from each suite (1014.2.2.2).
• Third, the travel distance between any point in a suite of sleeping rooms and an exit access exit door shall not exceed 100 feet (1014.2.2.2).

**Design Solution**

By utilizing the horizontal exit concept, the following will preserve the original design intent and provide code compliance:

• Separate the intended 9,700 square foot space into two suites, each less than 5,000 square feet.
• Provide a 2-hour fire barrier wall as the separation (Section 1022.2)
• Provide horizontal exits in the separation as one of two required exits from each space (Section 1014.2.2.2).
• Provide a 90 minute opening protective (Table 715.4). In this case, because the Won-Door FireGuard is not limited in width as a labeled and approved door assembly, the FG90 can serve as a wide-span opening protective and leave the space open without compromising code requirements.
The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   • 2006 IBC Section 1008.1.2, Exception #6
   • 2006 Section 1008.1.3.3 (Compliance Criteria)
   • 2006 NFPA 101, 7.2.1.4.1.5
   • 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

Inquiry Discussion and Questions

It has been said by many that the horizontal exit is probably one of the least understood and least utilized concepts of the building code. The following questions may be helpful in promoting awareness:

• Do you encounter travel distance problems in areas of the code other than the standard travel distance tables? (this case study for example)
• When designing a horizontal exit, does the 2-hour wall inhibit the openness of the space under consideration?
• In health care or prison design may I show you how a required smoke barrier can also serve as a horizontal exit?
Exit Passageway

Section 1021

An exit passageway provides the designer with an acceptable way of connecting a required exit stair to the exit discharge. Because the code requires an exit stair to open directly into an exit discharge to the exterior of the building, this provision will allow the stair to terminate at convenient locations away from the exterior walls. Also, the exit passageway can extend the path of travel when travel distances in the exit access system have been exceeded.

Fire & Life Safety Concerns

Extending the path of egress beyond the terminated travel distance or beyond the exit vestibule increases the potential for building occupants to be exposed to fire, smoke or hot and toxic gases. For these reasons exit passageways are designed with more strict provisions.

Code Requirements

1. An exit passageway shall not be used for any purpose other than as a means of egress (1021.1).
2. Exit passageway enclosures shall have walls, floors and ceilings of not less than 1-hour ... and be constructed as fire barriers (1021.3).
3. Elevators shall not open into an exit passageway (1021.4).
4. Opening protectives shall comply with Section 715 ... and shall be limited to those necessary for exit access to the exit passageway from normally occupied spaces and for egress from the exit passageway (1021.4).

Design Solution

In this case study the required exit stair from the floors above terminated several feet from the exterior of the
building. Because of the wide span listed door label the Won-Door FireGuard left the space open between the stair and the exit discharge to the outside.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

Inquiry Discussion and Questions

Because exit passageways are constructed under strict opening provisions, designs rarely incorporate them unless there is no other choice. With the use of the Won-Door FireGuard product openings are not limited in size and little or no design compromise is noticed by building occupants. The following questions can be helpful in assisting the design professional to recognize new options:

- Have you ever desired to terminate a required exit enclosure on the interior of the building rather than at the exterior exit?
- Do you find challenges in connecting an exit enclosure with the exit to the exterior of the building?
- Did you know that solving a travel distance problem by providing an exit passageway can open your design rather than close it down?

Notes:
Pedestrian Walkways & Tunnels

Section 3104

Walkways and tunnels are designed to provide connection between buildings. They can be located at, above or below grade level and are used as a means of travel by persons.

Fire & Life Safety Concerns

Buildings located across lot lines from each other are required to have fire-rated exterior walls to prevent fire and smoke from passing between them (704; Table 602). Walkways and tunnels connect and penetrate these rated exterior walls compromising protection potentially allowing heat and smoke to pass from one building to another.

Code Requirements

Section 3104 details specific requirements to ensure building occupant safety. These requirements are based upon the following fundamental principles:

Principle #1 – Connected buildings shall be considered to be separate structures (3104.2). Unless the buildings are all on the same lot or exempt under specific accessibility requirements each building will be considered as a separate building when determining fire resistance, exterior wall ratings and egress.

Principle #2 – The pedestrian walkway shall be of noncombustible construction (3104.3). Unless each building being connected is of combustible construction the connecting element must be noncombustible to minimize the travel of heat and smoke.

Principle #3 – Once the rated exterior walls have been penetrated to accommodate a noncombustible connecting walkway, the interior of each building must be further protected with fire barriers of not less than 2-hour rated construction (3104.5). In order to avoid this requirement the following criteria must be met:

Exception #1 – The distance between the connected buildings is more than 10 feet ... the wall is constructed of a tempered, wired or laminated glass wall and doors subject to the following:

1.1. The glass protected with sprinklers in order to wet the entire surface of the interior glass.
1.2. Glass must be manufactured and installed in gasketed frames to avoid breakage with deflection from extreme heat.
1.3. Obstructions shall not be installed between the sprinkler heads and the glass.

Exception #2 – The distance between the connected buildings is more than 10 feet and the sidewalls of the glass are at least 50% open.

Exception #3 – Buildings are on the same lot.

Exception #4 – Where buildings are required by Section 704 to be rated more than 2 hours the walkway must be equipped with an NFPA 13 sprinkler system.
Design Solution

The alternatives to fire barrier separations as listed above are very costly. Complying with the 2-hour separation requirement in Section 3104.5 is the least expensive option. A listed and labeled wide span Won-Door FireGuard FG90 will easily protect any size opening of unlimited width and heights to 28 feet.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)
Inquiry Discussion and Questions

Pedestrian walkways can be located overhead connecting two buildings or underground as tunnels connecting two buildings. This connecting construction is viewed as a definite threat to life safety. The code attempts to build in safety measures that are intended as substitutes for complete and optimum separation. These substitutes include extensive active wet sprinkler systems, open side walls, and tempered and/or wire glass components. It would certainly make more sense to use the “real thing” by easily providing rated barriers with wide-span opening protectives at each end eliminating any threat of fire and smoke entering the walkways.

The following questions may be helpful:

- Have you been able to run a cost comparison separating the building from the walkway as opposed to protecting the walkway?
- Even though a pedestrian walkway will most likely be constructed of non-combustible materials, would you like to avoid the cost of sprinklers, limiting interior design and costly tempered and/or wired glass components?

Notes:
Elevator Separation

Elevator Lobby

Elevator Smoke & Draft
**Elevator Lobby**

Section 707.14.1

The elevator lobby is designed to isolate the fire-rated elevator shaft enclosure and its doors from the remainder the floor on which it opens. The building code does not require this separation until four or more stories are connected together (707.14.1).

### Fire & Life Safety Concerns

Elevator shafts commonly represent the largest vertical shafts in multi-story buildings. These shafts become passageways for heat, smoke and other toxins from the fire to additional floors. There are several shaft protection alternative requirements available to the designer in addition to lobbies. These alternatives are acceptable because the charging language driving the requirement speaks to number of stories penetrated in lieu of opening on to rated corridors.

### Code Requirements

Elevator lobbies are considered the most efficient and economical solution to prevent the spread of smoke, heat and toxins in multi-story buildings. However, the following alternative methods are conditionally approved by exception in Section 707.14.1:

- **Exception #1** – Not required at the street floor when the entire floor is sprinklered.
- **Exception #2** – Elevators that are not required to be located in a shaft in accordance with Section 707.2.
- **Exception #3** – Where additional doors are provided at the hoistway opening complying with UL 1784. In this case a swing door may be placed at the point of access to the car, however it is important to note that each opening must be protected individually.
- **Exception #4** – In prisons and buildings 75 feet or less, lobbies are not required as long as the entire building is sprinklered. This requirement acknowledges that occupants in lo-rise buildings can be assisted for evacuation by fire department personnel on foot and/or with fire truck ladders.
- **Exception #5** – Smoke partitions (non-rated) can used in lieu of fire partitions to create the lobby as long as the entire building is sprinklered.
- **Exception #6** – Not required when the hoistway is pressurized.

### Design Solution

The design of an elevator lobby is typically the least intrusive and least expensive option in multi-story buildings for elevator shaft protection. The Won-Door FireGuard door assemblies easily accommodate radius applications, wide-span openings and are an approved means of egress. The use of the Won-Door FireGuard door assembly eliminates the need for cased openings or jambs and allows for recessed installation into walls and ceilings providing clear open appearance.

Note: The building code now requires in buildings four stories or more at least one elevator dedicated as a means of egress for the disabled during an emergency or fire (Section 1007.2.1).
In order to access the elevator the opening protective, whether it be at the point of access or part of the lobby, must be an approved self and automatic closing conforming exit assembly (Section 1008.1). This can only be achieved with a horizontal sliding type fire door approved in a means of egress or a conventional swing door.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

**Inquiry Discussion & Questions**

Any one of the above listed six Exceptions will allow the designer to comply with the elevator separation requirements. The six options are a combined total of both active and passive systems. For example sprinkler systems or shaft pressurization systems are active systems that either move water or air as discussed in Exceptions #1 and #6. These are considered active systems because when there is an alarm these mechanical devices go into action and actually put the fire out with water or move enough air in the elevator hoistway shaft to eliminate smoke from entering.

Passive systems are best illustrated by Exceptions #3 and #4. When the building goes into alarm enclosures are formed either around the elevator space or at the point of access to the car in order to stop smoke from spreading. Similar to fixed walls these enclosures are considered passive because they are non-mechanical and do nothing to extinguish or eliminate fire and smoke, the enclosures simply block it from passage. In all cases passive redundant systems are
less expensive than wet or active systems. Most often passive and active systems compliment each other as illustrated in Exception #5.

The design professional must consider two critical areas – cost and appearance. The optimum circumstance is to have a non-obtrusive ambiance at minimal cost, but this cannot be achieved equally with each of the six options. Listed below are fundamental principles, as associated with some of the six exceptions, combined with pertinent questions to address possible solutions:

- **Exception #3** allows protection at the point of access to the car without creating a lobby. The two products other than Won-Door that are compliant with the UL 1784 language are conventional swing doors and vertical rolling barriers. Let’s discuss each:

  *Side-hinged swing doors* — From the cost perspective this is certainly a less expensive option. From the appearance and functionality of the space point of view this option is very difficult. The swing door must be held open on an electro-magnetic catch that is mounted adjacent the hinged side of the door. This requires large areas of wall space to accommodate the width of the swing door which must be equal to the width of the elevator car door opening located next to the car opening. This is nearly impossible to accomplish with multiple elevator door openings and elevator control buttons.

  Also, the following language in the code presents challenges in minimum width corridors – rated or non-rated:

  *(IBC) 1005.2 Door encroachment.* Doors opening into the path of egress travel shall not reduce the required width to less than one-half during the course of swing. When fully open, the door shall not project more than 7 inches (178 mm) into the required width.

  In order for the elevator car opening to accommodate a side-hinged swinging door assembly the jamb must be framed and cased as well as electrical rough-in and hardware finish for the hold-open device installed. In multiple elevator car door applications it is questionable as to any significant cost savings. Obviously appearance is very undesirable whether a single or multiple applications.

  *Vertical Rolling Barriers* — Vertical rolling steel doors or films are not approved by the building code as conforming exit doors in a means of egress. Overhead rolling steel doors have never been allowed at the point of access to the elevator car, however, rolling vertical films have been permitted.

  Until recent acceptance of Accessibility provisions the elevator car was not a component of the means of egress system. Therefore an elevator car was not considered an occupied space in the building. This reasoning was based on the premise that when a building goes into fire alarm the elevators would lock-out (not be accessible from any other floor) and immediately return to the ground floor thereby disallowing any building occupant to ingress or egress the elevator car until it was safely out of danger. Should the elevator malfunction and stop on an intermediate floor it would then be necessary to allow the elevator car occupant(s) to choose whether or not to exit the car. Any protection at the point of access to the elevator car at this juncture must comply with the code:

  *(IBC) 3002.6 Prohibited doors.* Doors, other than the 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.

  Some jurisdictions allow the roll-down films to be used in this application because they incorporate side-jamb magnets so that when the film is pushed from the car side it will detach from the door frame jambs and allow egress. It is assumed this egress function can
take place “without a key, tool, special knowledge or effort.”

However, the introduction of the International Building Code brought with it new Accessibility provisions in Section 1007 specifically placing elevators as a component of the Exit and Exit Access portions of the Means of Egress system in buildings four stories or more in height. Therefore anything placed at the point of access to an elevator car considered a part of an accessible means of egress must conform to the requirements of a required exit assembly. These new Accessibility provisions require ingress into the elevator as well as egress out of the elevator car. Roll-down films are not in compliance.

From a cost perspective, particularly in multiple elevator car applications, it is very expensive to separate individual openings. Overall, a full lobby created with concealed wide span opening protective is less expensive and does not compromise the design of the space.

• **Exception #4** is designed to exempt lo-rise (less than 75 feet above the lowest level of fire department access) buildings from having elevator separation provisions. Fire truck ladders can reach 100 feet, it is assumed that access to most buildings will be within 25 feet or less suggesting a 100 foot ladder’s maximum reach to be 75 feet.

The elevator lobby provisions are calculated to defend-in-place building occupants until rescue help arrives. In lo-rise conditions the wait time is minimal due to the reach of the ladders, therefore lobbies are not required.

• **Exception #5** provides an alternate means of construction of the walls creating an elevator lobby. Even though this provision allows non-rated construction with smoke partitions the opening protective must remain UL1784 listed. The passage of smoke is still an issue and rated opening protective are still required.

• **Exception #6** is a very expensive alternative when the building exceeds 5 or 6 stories. The greater the cubic footage of space to pressurize the greater the cost in mechanical equipment to do the job. Most designers have suggested this alternative is equitable in 5 and 6 story buildings as compared with passive redundancy. However all agree that beyond this 5th or 6th level passive redundant lobbies are the least expensive alternative in multi-story buildings to satisfy elevator separation requirements.

The following questions regarding hi-rise buildings may be helpful:

• Most elevator core areas exceed 10 feet in width. When creating an elevator lobby separation do you find it difficult to maintain clear open appearance using traditional swing doors, due to head and jamb requirements, with a maximum 8 foot width?

• Would you like to delete the build-outs created to accommodate swing doors on magnetic hold-open devices at the elevator lobby?

• Have you considered the additional cost and the appearance of custom swing doors on hold-up devices in protecting the elevator lobby?

• In multiple elevator applications have you considered the increased cost of designing individual elevator separation over a simple lobby approach?

• What is the cost difference between pressurization and a simple lobby?

• Are you aware there are significant problems certifying pressurization systems?

• Are you required to have at least one elevator as an accessible means of egress? If so, do you have conforming exit assemblies at the point of access to the elevator car?

• How do you distinguish separation between standard elevators and conforming accessibility elevators?
Elevator Smoke & Draft
Section 715.4.3.1

Elevator car doors are typically fire-rated but cannot comply with smoke and draft requirements. Smoke & draft rated assemblies eliminate the passage of smoke and are usually located at the point of access to an elevator car as an alternative to the elevator lobby.

Fire & Life Safety Concerns

Elevator shafts commonly represent the largest vertical shafts in multi-story buildings. These shafts become passageways for heat, smoke and other toxins from the fire to additional floors. In buildings that connect more than three stories the conventional elevator lobby is presumed to stop fire and smoke with no requirement for the lobby doors to be smoke and draft rated. However, when eliminating the lobby there is concern that smoke can penetrate quickly at the point of access to the shaft. Therefore, all fire-rated assemblies used at the point of access must maintain a smoke and draft rating (UL 1784).

Code Requirements

In the legacy codes the elevator protection requirements were driven by the rated corridor provisions. In other words, whenever an elevator opened to a rated corridor the threat of creating a “dirty” (smoke & heat filled) corridor was mitigated by providing protection at the point of access in lo-rise construction and a conforming lobby in hi-rise construction.

Currently in the IBC protection at the elevator is driven only by “where an elevator shaft connects more than three stories” (707.14.1). At first glance one would think a four story building less than 75 feet in height (lo-rise by definition) would require elevator protection. However, Exception #4, 707.14.1 explains that if the building is sprinklered and has occupied floors more than 75 feet above the lowest level of fire department access, elevator separation is not required. Therefore, this application becomes a code requirement in rare cases where a building connects more than 3 stories, is less than 75 feet in height and is not sprinklered.

Please note: All assemblies located at the point of access to an elevator car must be readily openable from the car side without a key, tool, special knowledge or effort (3002.6).
Design Solution

Due to the unlimited width listing of the Won-Door FireGuard assemblies several elevator openings can easily be protected with one Won-Door FireGuard door. Fire exit panic hardware can be placed at each elevator car door opening to accommodate conforming exit requirements.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)

Inquiry Discussion & Questions

In hi-rise buildings this application is allowed under Section 707.14.1, Exception #3. Please consult the Inquiry Discussion & Question section of the Elevator Lobby case study.
Notes:
Smoke Compartmentation

Smoke Compartments – Healthcare
Smoke Barriers – Healthcare
Smoke Compartments – Healthcare
Section 1014.2.2

The compartmentation requirements in this case study are unique to hospital occupancies and are driven, for the most part, by means of egress provisions.

Fire & Life Safety Concerns
The code allows patient rooms to be arranged in open suites. However, this type of arrangement supposes a low patient-to-staff ratio where the staff is directly responsible for the safety of the patients in the event of a fire. To ensure safety, small smoke compartments with short egress to protected exits become critical.

Code Requirements
1. Habitable rooms or suites in Group I-2 occupancies shall have an exit access door leading directly to a corridor. (1014.2.2)
2. Suites of patient sleeping rooms shall not exceed 5,000 square feet. (1014.2.2)
3. Suites of other than patient sleeping rooms shall not exceed 10,000 square feet. (1014.2.2)
4. Any patient sleeping room, or any suite that includes patient sleeping rooms, of more than 1,000 square feet shall have at least two exit access doors remotely located from each other. (1014.2.2)
5. Any room or suite of rooms other than patient sleeping rooms of more than 2,500 square feet shall have at least two access doors remotely located from each other.
6. Travel distance between any point and an exit access door in a room shall not exceed 50 feet. (1014.2.2)
7. Travel distance between any point in a suite of sleeping rooms shall not exceed 100 feet. (1014.2.2)
8. Vision panels are required in cross-corridor application of I-2 occupancies. (709.5)
9. Walls designed to create smoke compartments shall be construction as non-rated smoke partitions.
10. Openings within smoke compartment walls that are not used to protect a vertical opening or an exit are not required to have a fire-rating but shall provide an effective barrier to limit the transfer of smoke. Also, these opening protectives do not have to be self-closing (Section 407.3.1).
Design Solution

In this case study we find it difficult to maintain continuity with compartmentation when passing through corridors or other open areas with smoke partition walls. With the wide-span capabilities of the Won-Door FireGuard assembly there is no compromise with building function ability and code compliance.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   a. 2006 IBC Section 1008.1.2, Exception #6
   b. 2006 Section 1008.1.3.3 (Compliance Criteria)
   c. 2006 NFPA 101, 7.2.1.4.1.5
   d. 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)
**Inquiry Discussion and Questions**

Often more desirable floor plans will be compromised to accommodate smoke compartmentation requirements. Rooms become smaller, corridors often inhibited with opening protectives, nurses stations altered, etc. to create life-saving smoke free spaces. Most often these adjustments become routine without an understanding of wide span opening protective technology.

The following questions may be helpful:

- May I show you how a smoke compartment separation can cross a corridor without compromising the space?
- Did you know that a horizontal sliding door can be used in a means of egress across a corridor regardless of the occupant load served?
- Would you like to eliminate cross-corridor conventional swing doors on hold-opens?
- Smoke compartments are no respecter of open spaces. Can I show you how you can span virtually any distance without compromising the space?
Smoke Barriers – Healthcare
Section 709

Smoke barriers divide areas of a building into separate smoke compartments. These dividing walls allow building occupants time to be evacuated or relocated to other smoke compartments. In other words, smoke barriers separate portions of buildings into areas of refuge capable of resisting the passage of smoke and fire for 1 hour (Section 709.4).

Fire & Life Safety Concerns
Smoke barriers are specifically required in I-2 (hospital) occupancies due to the non-ambulatory status of the building occupants (Section 407.4). Usually these occupants require assistance and care when being evacuated or relocated during an emergency. There must be a protected area where these patients can be placed until safely evacuated from the building. Smoke barriers in Group I-2 occupancies provide this defend-in-place mechanism.

Code Requirements
The following five requirements designate the use of smoke barriers in Group I-2 occupancies:

1. Group I-2 occupancies are required to subdivide every story into smoke compartments with an area not more than 22,500 square feet. (407.4)
2. Smoke compartments are to be divided using smoke barrier walls in accordance with Section 709. (407.4)
3. Smoke barriers are required to subdivide every story used by patients for sleeping or treatment with an occupant load of 50 or more persons into at least two compartments. (407.4)
4. Travel distance in smoke compartments shall not exceed 200 feet. (407.4)
5. Independent egress – A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated (Section 407.4.2).

In order to accommodate an opening in a smoke barrier wall the following opening protective requirements must be met:

1. Minimum fire rating of 20 minutes (Section 715.4.3 & Table 715.4).
2. Vision panels (Section 709.5). Please note this section does not specifically exclude horizontal sliding type fire doors, see ESR-ES1394, Section 3.5.1.
Design Solution

In this case study the intent is to add to an existing I-2 occupancy a 9,700 square foot Critical Care Suite. The existing building construction type is IIIA with 21,324 square and the desire is to have the new suite as open as possible to the existing hospital corridor system. The placement of a smoke barrier wall at this new addition connection is a specific code requirement in order to fall within the 22,500 square foot limitation. With the use of the Won-Door wide-span labeled assembly approved for egress, the opening protective requirements are met without compromising the spacious clear open ambiance desired.

The Won-Door FireGuard complies as an opening protective as well as a conforming exit:

1. ICC-ESR-1394, Section 3.5, Opening Protective
2. ICC-ESR-1394, Section 3.6, Means of Egress
   - 2006 IBC Section 1008.1.2, Exception #6
   - 2006 Section 1008.1.3.3 (Compliance Criteria)
   - 2006 NFPA 101, 7.2.1.4.1.5
   - 2006 NFPA 101, 7.2.1.14 (Compliance Criteria)
Inquiry Discussion & Questions

In principle, smoke compartmentation and smoke barrier separation are the same with minor differences. Smoke barriers are created using 1-hour rated walls (Table 715.4) and the separations are incurred at a minimum of 22,500 square feet. Smoke compartments are created using non-rated smoke partitions and the separations are incurred at a minimum of 5,000 square feet in suites of sleeping rooms and 10,000 square feet in non-patient room areas. Smoke compartment applications occur in Group I-2 occupancies/hospitals and Smoke Barrier applications occur in Group I-2 and/or Group I-3 occupancies/prisons.

Helpful questions for smoke barrier applications can be found in the smoke compartmentation case study.

Notes:
References

IBC Chapter 10, Section 1008
NFPA 101 Chapter 7, Section 7.2
ICCES ESR1394
International Building Code, 2006
Means of Egress

1008.1.2 Door Swing. Egress doors shall be side-hinged swinging.

Exceptions:

6. In other than Group H occupancies, horizontal sliding doors complying with Section 1008.1.3.3 are permitted in a means of egress.

1008.1.3.3 Horizontal sliding doors. In other than Group H occupancies, horizontal sliding doors permitted to be a component of a means of egress in accordance with Exception 6 to Section 1008.1.2 shall comply with all of the following criteria:

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.
2. The door shall be openable by a simple method from both sides without special knowledge or effort.
3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.
5. The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic closing by smoke detection in accordance with NFPA 80 and shall comply with Section 715.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.
Means of Egress

7.2.1.4 Swing and Force to Open

7.2.1.4.1.5 Horizontal-sliding doors complying with 7.2.1.14 shall be permitted.

7.2.1.14.1 Horizontal-Sliding Doors. Horizontal-sliding doors shall be permitted in means of egress, provided that the following criteria are met:

1. The door is readily operable from either side without special knowledge or effort.
2. The force that, when applied to the operating device in the direction of egress, is required to operate the door is not more than 15 lbf (67 N).
3. The force required to operate the door in the direction of door travel is not more than 30 lbf (133 N) to set the door in motion and is not more than 15 lbf (67 N) to close the door or open it to the minimum required width.
4. The door is operable using a force of not more than 50 lbf (222 N) when a force of 250 lbf (1100 N) is applied perpendicularly to the door adjacent to the operating device, unless the door is an existing horizontal-sliding exit access door serving an area with an occupant load of fewer than 50.
5. The door assembly complies with the fire protection rating, if required, and, where rated, is self-closing or automatic-closing by means of smoke detection in accordance with 7.2.1.8 and is installed in accordance with NFPA 80, Standard for Fire Doors and Fire Windows.
Additional report - ICCES ESR1394 - goes on these two pages. This document is the pdf.
Additional report - ICCES ESR1394 - goes on these two pages. This document is the pdf.
The International Code Council Evaluation Service (ICC ES) evaluates products to ensure code compliance. Acceptance and approval of the horizontal sliding type fire door technology by local building officials require that a current International Code Council Evaluation Service Report (ICC-ESR, Won-Door ESR#1394) be submitted to the authority having jurisdiction (AHJ). This document confirms that a product meets or exceeds the building code criteria. Without verification of this evaluation service research, the building official does not have authorization of compliance.

Note: A fire test, as verified by a certified testing agency label affixed to the assembly, is authorization of compliance for a fire test only and does not certify compliance with other critical regulatory requirements for horizontal sliding type fire doors and their many applications. Consider the following areas of compliance, evaluated by the ICC ES, that must accompany a labeled fire door assembly with written certification in specific applications:

1. U.L. 864 - Closing System Certification as required by NFPA 80
2. U.L. 1784 - Smoke & Draft – “S” Mark
5. U.L. 10T3 - Fire Alarm Equipment and Releasing Device
6. IBC 1008.1.3.3 - Egress Compliance
7. TR - Temperature Rise Compliance
8. NFPA 80 Compliance
This document has been prepared by the Won-Door Corporation. It is intended to assist interested parties in understanding the use and applications of the Won-Door FireGuard product from a building code perspective. Building code interpretations herein are the sole property of Won-Door Corporation.

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