2018 "Effective Application of the Special Use and Occupancy Provisions of the IBC

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Description

- This course provides an overview of selected 2018 IBC Chapter 4 provisions and the application of the code requirements for special uses and occupancies that are addressed in Chapter 4.

Objectives

- To provide a basic understanding of provisions of Chapter Four special use and occupancy provisions of the IBC.
- Give an understanding of the relationship of provisions to special occupancies listed within Chapter four and how it relates to the rest of the building as covered elsewhere within the code.
- Application of IBC requirements to special building features and hazardous work or storage locations within a structure.

Mixed Occupancy and Mixed Use Buildings

Philosophy of Code - Most Occupancies Today are mixed use occupancies.

- It is necessary to determine if the structure is a specific occupancy type and then the use of individual spaces within the occupancy.
- Secondly, it is important to understand the difference between occupancy and use. Some uses are allowed within the primary occupancy to be considered as having the same occupancy type as the primary occupancy. For example a school gymnasium which is part of an E Occupancy is considered to have the E Occupancy classification. Where a gymnasium that is part of a B Occupancy University Building is classified as an A-3 or A-4 Occupancy depending upon whether there is spectator seating.
- If considered as accessory use to the primary occupancy and composing less than ten percent of the overall floor area then it would be an assembly use, but, part of the primary occupancy type for the building.

Key Objectives

- Apply the special provisions applicable to special building features, such as atriums, stages and platforms, and storm shelters.
- Apply special considerations for Groups H, I and R, as well as ambulatory care facilities
- Apply special requirements for hazardous materials and spray finishing operations

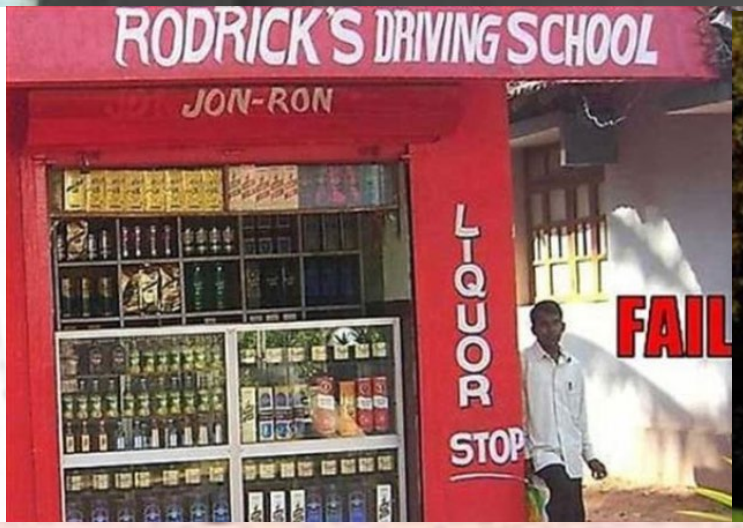
Overview of IBC Chapter 4

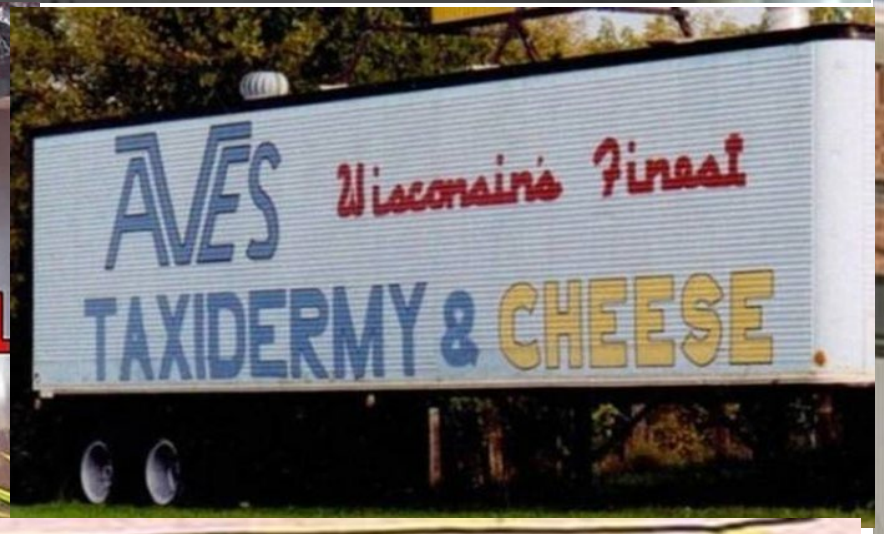
Key Concepts of Chapter 4

- ✓The detailed requirements in Chapter 4 are varied in their scope and application.
- ✓The provisions found in Chapter 4 typically modify or expand the general requirements established throughout the IBC.
- ✓The provisions of Chapter 4 are specific.
- ✓Provisions of Chapter Four take precedence over any general provisions elsewhere in the IBC.

Special Types of Buildings

Unusual uses of usual buildings?





Ahlgrim & Sons Ltd. Funeral Parlor and Mini-Golf, 201 N Northwest Hwy., Palatine, (847) 358-[redacted]

Free inside mini golf. Call ahead, because play is canceled if there is any funeral work. "We want folks to know we're not so scary; we're people. A funeral parlor is not a dark place, but a safe and secure one; we

- 401 – Scope
- 402 – Covered Mall and Open Mall Buildings
- 403 - High Rise Buildings
- 404 - Atriums
- 405 - Underground Buildings
- 406 - Motor Vehicle Related Occupancies
- 407 - Group I-2
- 408 - Group I-3
- 409 – Motion Picture Projection Rooms
- 410 – Stages, Platforms & Technical Production
- 411 – Special Amusement Buildings
- 412 – Aircraft Related Occupancies
- 413 – Combustible Storage
- 414 – Hazardous Materials
- 415 – Group H-1, H-2, H-3, H-4, H-5
- 416 – Application of Flammable Finishes
- 417 – Drying Rooms
- 418 – Organic Coatings
- 419 – Live/Work
- 420 – Groups I-1, R-1, R-2, R-3, R-4
- 421 -Hydrogen Fuel Gas Room
- 422 - Ambulatory Care
- 423 - Storm Shelters
- 424 – Children's Play Structure
- 425 - Hyperbaric Facilities
- 426 – Combustible Dusts, Grain Processing & Storage
- **427 Medical Gas Systems**
- **428 Higher Education Laboratories**

Chapter Four Scope

401.1 Detailed occupancy and use requirements. In addition to the occupancy and construction requirements in this code, the provisions of this chapter apply to the occupancies and use described herein.

Mall Buildings Section 402

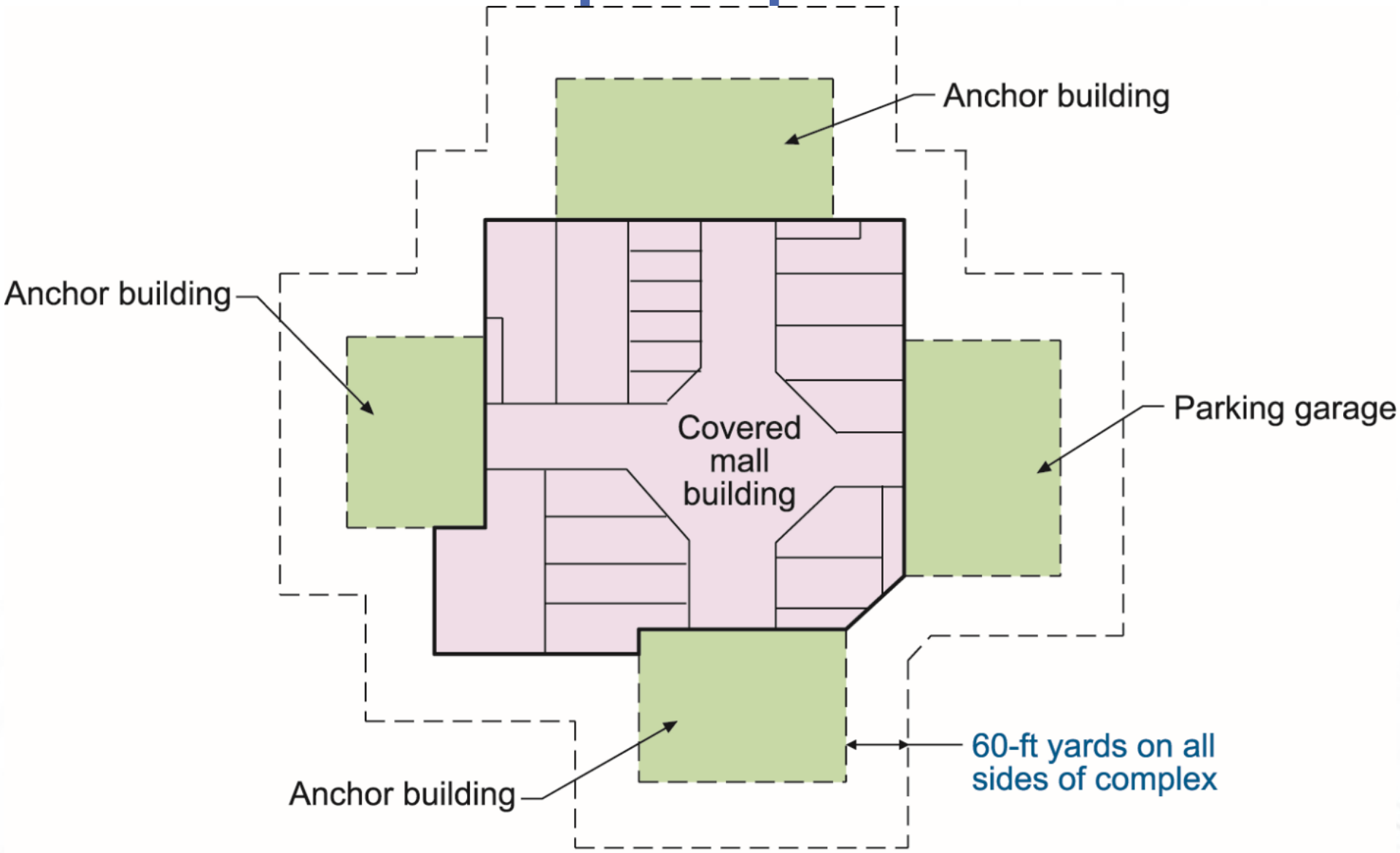
Section 402 Covered Mall and Open Mall Buildings

- The special provisions applicable to covered mall buildings and open mall buildings are only applicable to those buildings no more than:
  - 3 floor levels and any point, and
  - 3 stories above grade plane.
- Buildings need not comply with Section 402 if they totally comply with other applicable provisions of the code.

Section 402.1.1 Open Space

- A required minimum open space of 60 feet must be provided in all directions around the perimeter of the mall building and at the perimeter of anchor buildings and parking garages attached to the covered mall building.
- The same open space is required to surround open mall buildings.
- The open space can be reduced in the same manner as for unlimited area buildings.

Section 402.1.1 Open Space

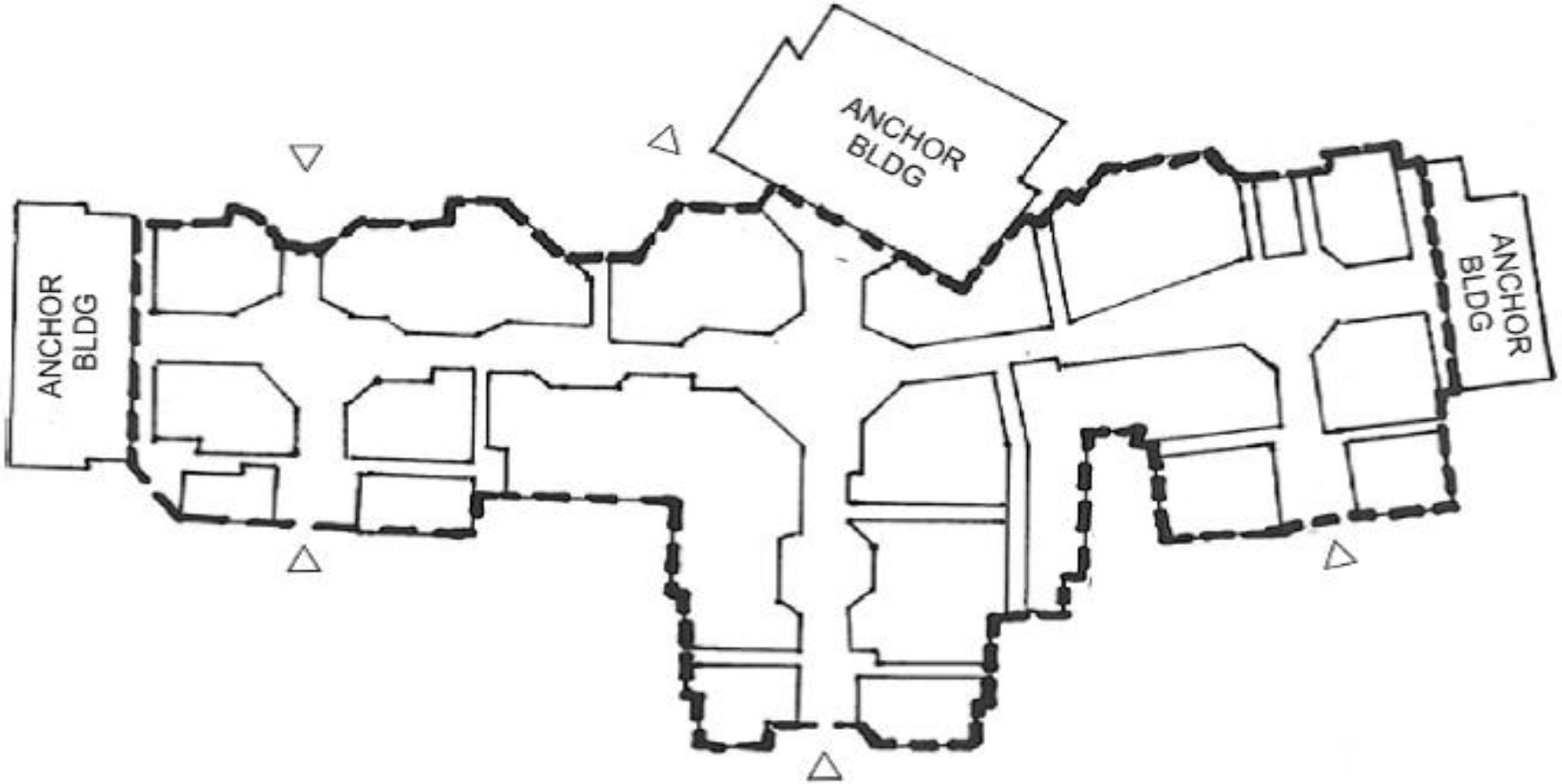


Unlimited area permitted if building surrounded by minimum 60-foot open space and of other than Type V construction.

Section 402.1.2 Perimeter Line

- A building perimeter line encircling all buildings and structures comprising an open mall building must be established.
- The perimeter line encloses all portions of the open mall building, including open-air walkways and spaces, but does not enclose any anchor buildings or parking garages adjacent to the open mall building.

Section 402.1.2 Perimeter Line



OPEN MALL BUILDING PERIMETER LINE

Figure 402.1.2
OPEN MALL PERIMETER

Section 402.4.1 Area and Types of Construction

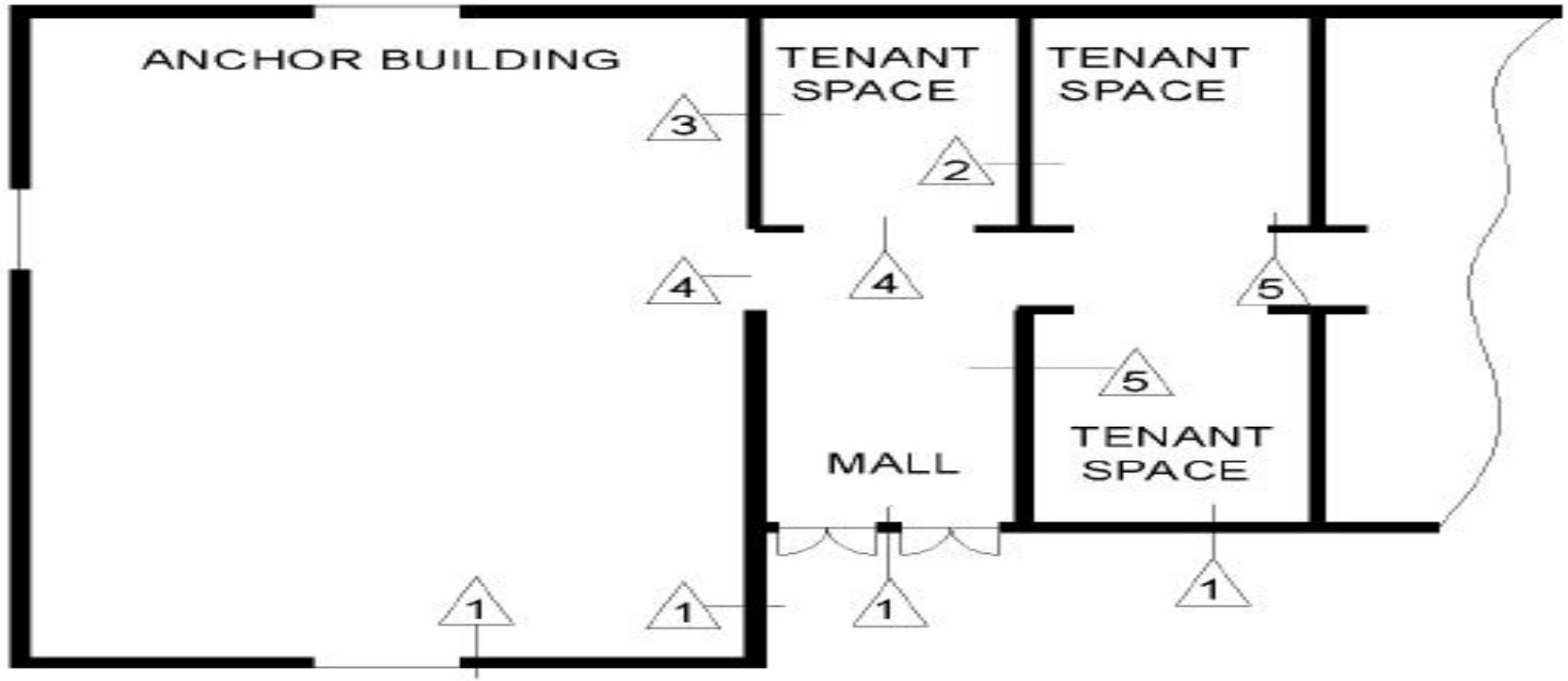
- Mall buildings and anchor buildings are addressed as special types of unlimited area buildings that are exempt from the area limitations of IBC Chapter 5 where.
  - Complying frontage is provided on all sides in all directions
  - Of Type I, II, III or IV construction
  - Not more than three stories above grade.
  - Limited in height to three floor levels at any point.

Section 402.4.2 Fire-resistance-rated Separations

- Historical experience on automatic sprinkler performance indicates separation between individual tenant spaces and the mall area is not warranted.
- However, in order to limit the spread of smoke, tenant separation walls are required to be fire partitions with a fire-resistance rating of at least 1 hour and continuity from the floor to the underside of the ceiling.

Section 402.4.2 Fire-resistance-rated Separations

- Anchor buildings are regulated as separate buildings.
  - As separate buildings, fire walls are required at the anchor/mall common wall.
  - Minimum 2-hour fire barriers may be used for separation when the anchor building is:
    - limited to 3 stories above grade plane, and
    - of the same occupancy as the general mall tenants.
  - Openings between the anchor building and pedestrian area of the mall need not be protected where the anchor building is of Type I or II construction.



1 WALL CONSTRUCTED AS REQUIRED FOR AN EXTERIOR WALL

2 WALL CONSTRUCTED AS REQUIRED FOR A TENANT SEPARATION BY SECTION 402.4.2.1

3 WALL CONSTRUCTED AS REQUIRED BY SECTION 402.4.2.2 (FIRE WALL OR FIRE BARRIER)

4 UNPROTECTED OPENING

5 WALL CONSTRUCTED AS REQUIRED BY SECTION 402.4.2

Figure 402.4
TENANT SPACE AND ANCHOR BUILDING SEPARATIONS

Section 402.4.3 Open Mall Construction

- A minimum open area width of 20 feet is required between opposing structures from the lowest grade level to the sky above.
  - The width of the opening is measured perpendicular from the face of the tenant spaces, essentially across the pedestrian mall.
- Balconies and other projections are permitted but may not project into the required 20-foot minimum mall width.

Section 402.6.2 Kiosks

- The restriction on the construction and location of kiosks is intended to minimize the potential for fire spread through the mall area.
  - Acceptable construction materials include: fire-retardant treated wood, foam plastics meeting specific ignition and heat release tests, and aluminum composite materials meeting Class A finish requirements.
  - Kiosks, kiosk groups and similar non-permanent structures are limited to 300 square feet in area.
  - Kiosk separation from other kiosks, kiosk groups or mall structures is 20 feet minimum.
  - Kiosks with roofs or covers require sprinklers and fire detection.

Section 402.7 Emergency Systems

- In addition to the automatic sprinkler system required by Section 402.5, the following systems are required:
  - Standpipes,
  - Smoke control,
  - Standby power,
  - Emergency voice/alarm communication and
  - Fire department access to equipment.

Section 402.8 Means of Egress

- Most of the special mall building means of egress requirements are based on the assumption that the use of a mall building will be primarily mercantile and business, with some assembly.
- The specific egress requirements in Section 402.8 supersede some of the more general provisions of Chapter 10.

Section 402.8.1 Mall Width

- Circulation routes in open and covered malls function as exitways without consideration as corridors.
  - 20-foot mall width minimum is based on the need to provide adequate access to the exits.
  - Width shall be sufficient for the occupant load served
- Every portion of the minimum width is to be maintained to a height of 8 feet. Kiosks, vending machines, furniture, displays and other potential obstructions are not permitted in any portion of the minimum required aggregate mall width.

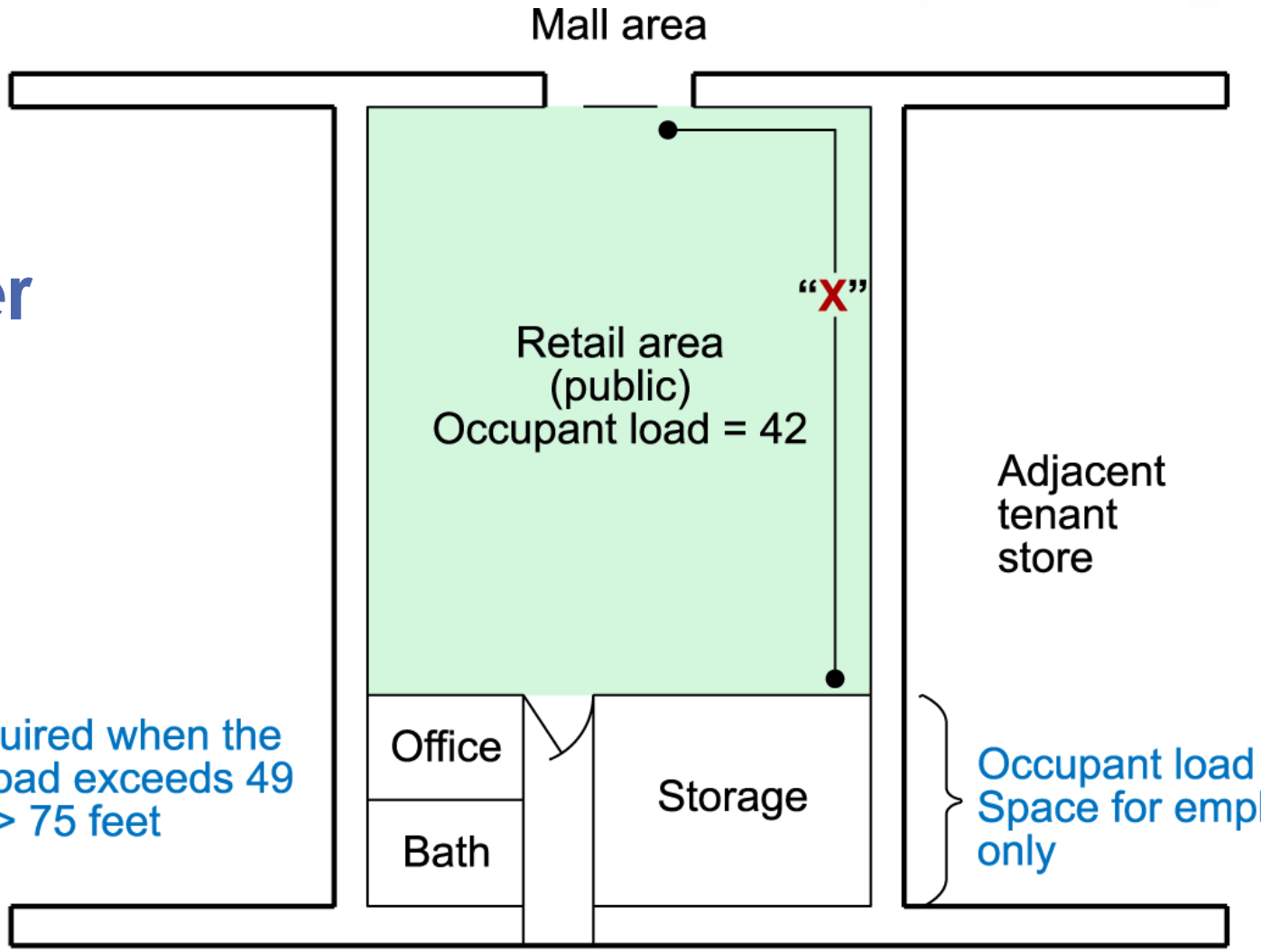
Section 402.8.2 Occupant Load Determination

- Since the tenant spaces of covered and open mall buildings can be used for varied occupancies, the design occupant loads will also vary.
- Each tenant space has its own occupant load calculated using the general provisions of Chapter 10.
- In addition, an occupant load determination is required to provide adequate egress from the mall itself.

Section 402.8.2.3 Anchor Buildings

- The required exit and exit capacities for an anchor building must be provided independent of the mall or mall exits.
- Since independent exits are provided, the occupant load of anchor stores is not included in determining the exit requirements for the mall.

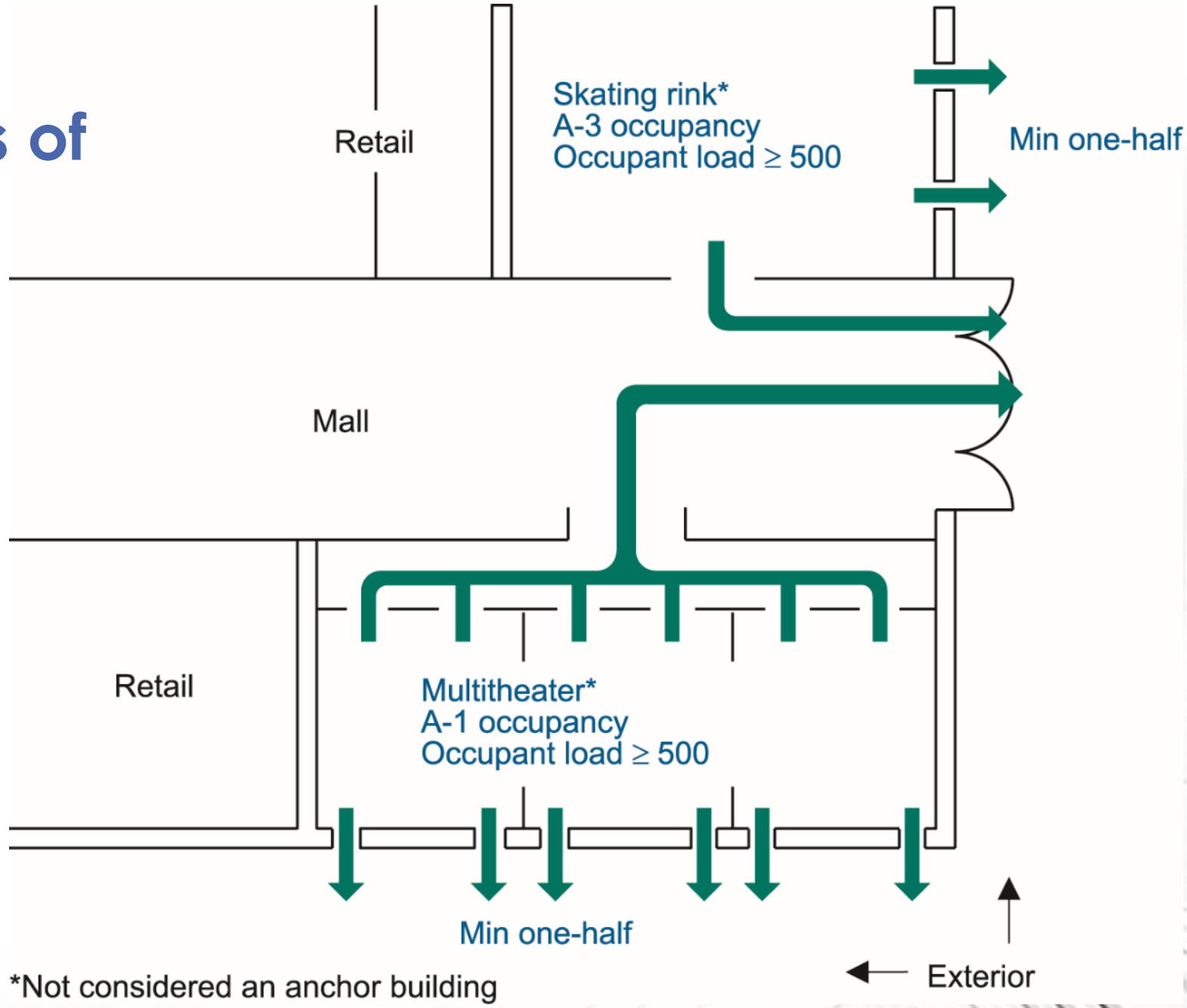
Section 402.8.3 Number of Means of Egress



Second exit required when the total occupant load exceeds 49 or "X" distance > 75 feet

For SI: 1 foot = 304.8 mm.

Section 402.8.4 Assembly Means of Egress



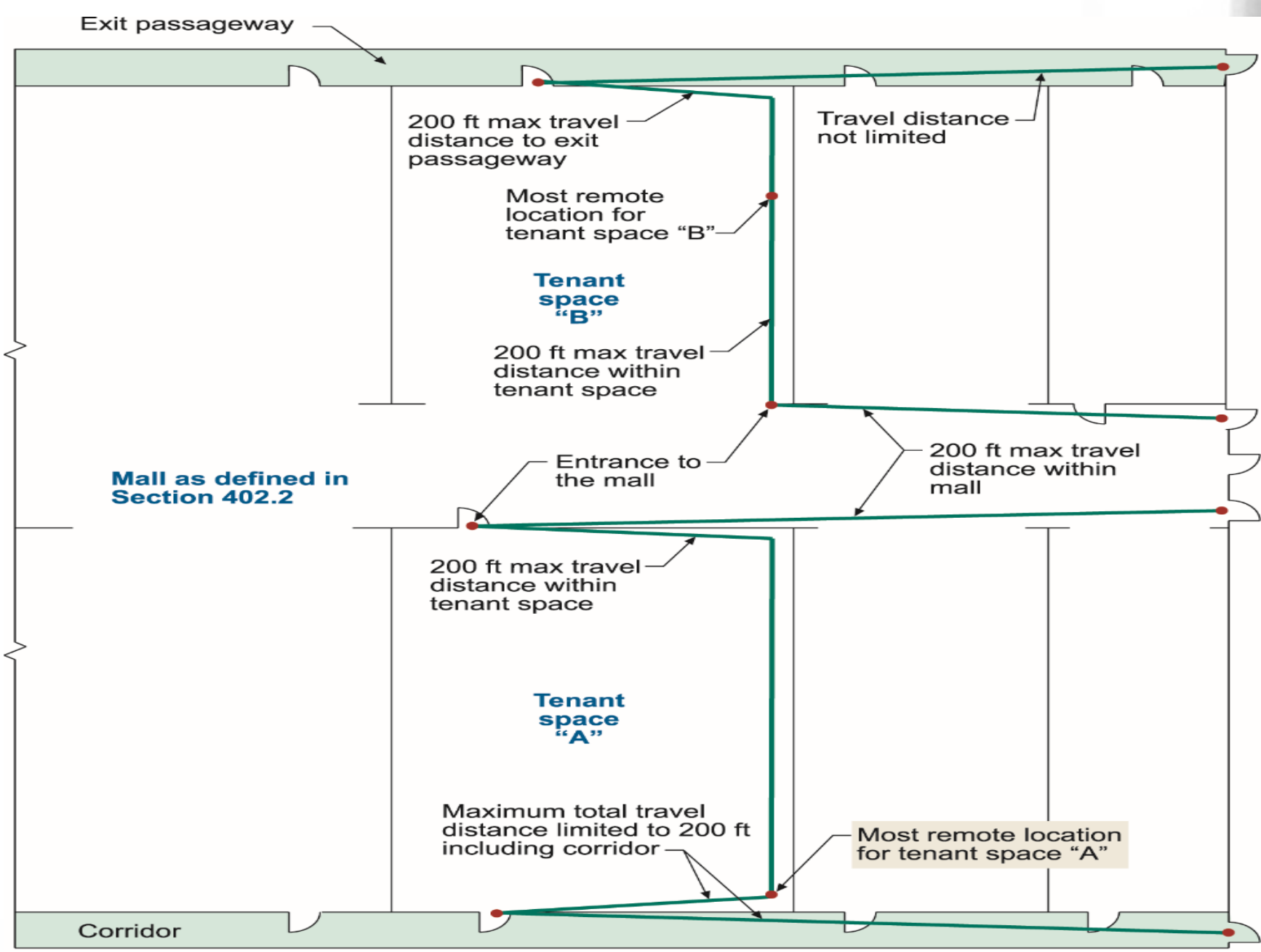
Section 402.8.4.1 Anchor Building Means of Egress

- The occupant load of anchor buildings is not included in determining the means of egress requirements for the mall.
- The required means of egress for an anchor building is as required by Chapter 10.

Section 402.8.5 Distance to Exits

- The maximum permissible travel distance from any point in a tenant space to the mall is 200 feet.
- The same 200-foot limitation is applied from any point within the mall in a covered mall building to an exit, as well as from any point within the mall of an open mall building to the perimeter line.

Section 402.8.5 Distance to Exits



Note: travel distance is to be measured along the natural and unobstructed path of egress travel.

For SI: 1 foot = 304.8 mm.

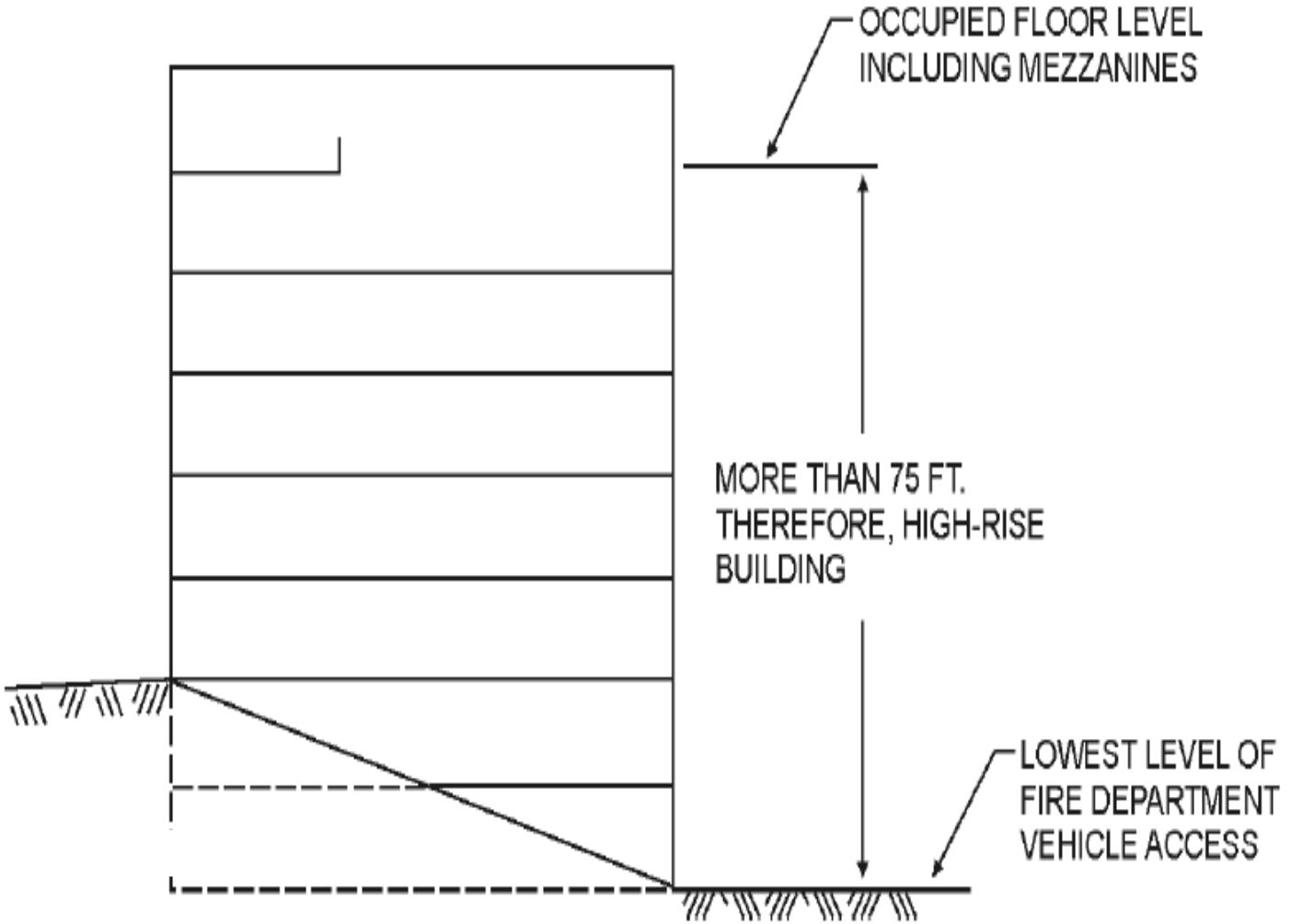
Section 402.8.8 Security Grilles and Doors

- Limits to the use of security grilles as a part of the means of egress include:
  - During business hours, a grille must remain in its full, open position.
  - Security grilles cannot be used for more than 50 percent of the exits serving a space.
  - A grille may be partially closed at a sole means of egress when less than 10 persons occupy the space.
  - A grille may be partially closed at one opening of a two-egress space when less than 50 persons occupy the space.

Section 403.1 High-rise Building Applicability

- All high-rise buildings, as defined by Section 202, are subject to the special provisions of Section 403, except for:
  - Aircraft traffic control towers
  - Open parking garages
  - Portions of buildings containing a Group A-5 occupancy
  - Special industrial occupancies
  - Buildings with Group H-1 and specified Group H-2 and H-3 occupancies

Section 202 Definition of High-rise Building



For SI: 1 foot = 304.8 mm.

Figure 403.1(1)
HIGH-RISE BUILDING

Section 403.2.1 Fire-resistance Ratings

A reduction is permitted in the required fire-resistance ratings for type of construction purposes where the building has sprinkler control valves equipped with supervisory initiating devices and water-flow initiating devices for each floor.

1. There are five areas where the provisions allows for reductions relative to Building Elements in Table 601.
2. For buildings not greater than 420 feet in height, the building elements (other than columns supporting floors) in Type IA construction are permitted to be reduced to those required for Type IB buildings.
3. In other than Group F-1, M and S-1 occupancies, the building elements in Type IB construction are permitted to be reduced to those required for Type IIA buildings

Section 403.2.1.2 Fire-resistance Ratings

4. For buildings not greater than 420 feet in height, the required fire-resistance ratings for vertical shafts (other than interior exit stairway and elevator hoistway enclosures) are permitted to be reduced to 1-hour.
   - Automatic sprinklers are required to be installed within the shafts at the top and at alternate floors.
5. Special structural integrity provisions for interior exit stairways and elevator hoistway enclosures must be applied to:
   - High-rise buildings of Risk Category III or IV, and All buildings more than 420 feet in building height.
   - The wall assemblies must comply with established levels of impact resistance as set forth in the provisions.

Section 403.2.3 Structural Integrity of Exit Stairway and Elevator Enclosures (continued)

- Special structural integrity provisions for interior exit stairways and elevator hoistway enclosures must be applied to:
  - High-rise buildings of Risk Category III or IV, and
  - All buildings more than 420 feet in building height.
- The wall assemblies must comply with established levels of impact resistance as set forth in the provisions.

Table 1604.5

III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing Group E occupancies with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.[a] • Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b]

Table 1604.5

IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2 occupancies having surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b] • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

Section 403.2.4 Sprayed Fire-resistant Materials

- The bond strength of the SFRM installed throughout the building shall comply with Table 403.2.4.

TABLE 403.2.4
MINIMUM BOND STRENGTH

HEIGHT OF BUILDING	SFRM MINIMUM BOND STRENGTH
Up to 420 feet	430 psf
Greater than 420 feet	1,000 psf

Section 403.4 Required Emergency Systems

- The detection, alarm and emergency systems required in a high-rise building are also a part of the fire- and life-safety package. Such systems include:
  - Smoke detection
  - Fire alarm system
  - Standpipe system
  - Emergency voice/alarm communication system
  - Emergency responder radio coverage

Section 403.4 (cont.) Required Emergency Systems

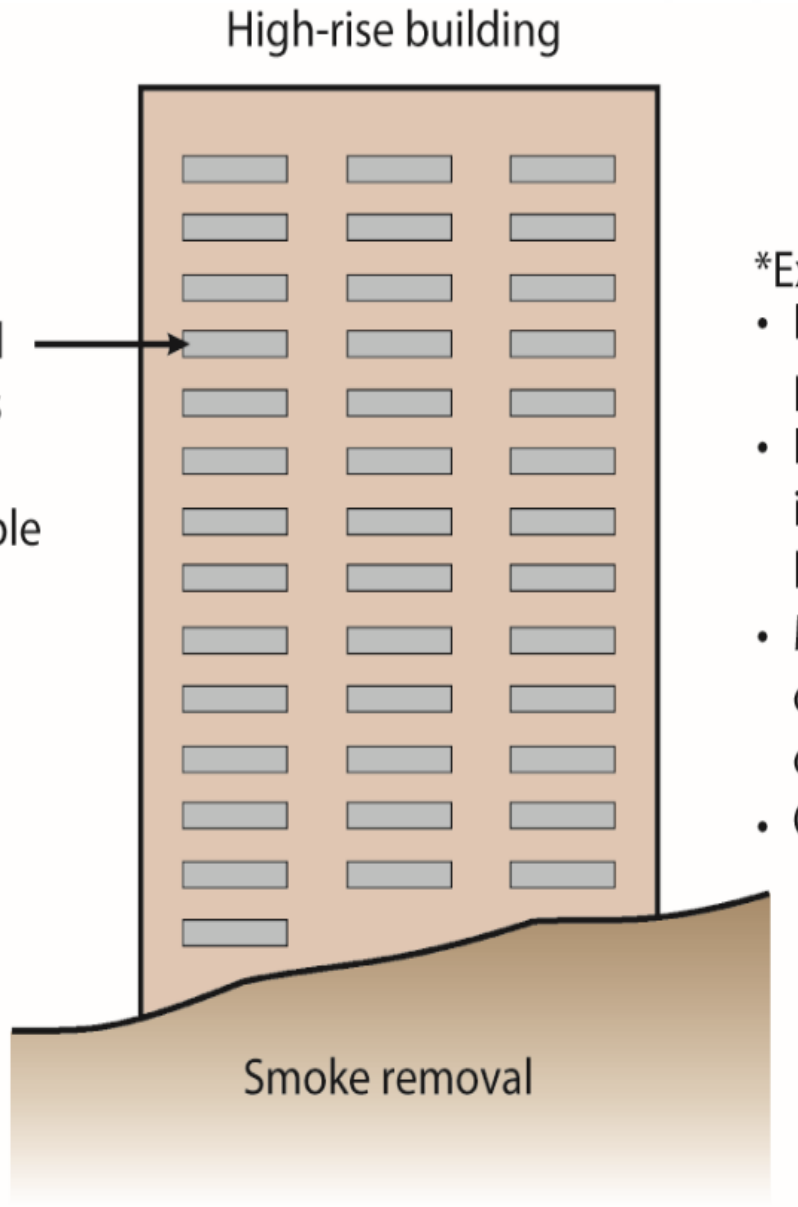
- The detection, alarm and emergency systems required in a high-rise building are also a part of the fire- and life-safety package. Such systems also include:
  - Fire command
  - Smoke removal
  - Standby and emergency power systems

Fire Command Center

[F] 403.4.6 Fire command. A fire command center complying with Section 911 shall be provided in a location approved by the fire code official.

Section 403.4.7 Smoke Removal

- A high-rise building must be provided with a system to facilitate smoke removal in post-fire and overhaul operations.



*Exceptions:
- Reduced venting area permitted in Group R-1.
- Fixed opening permitted if glazing can be cleared by fire fighters.
- Mechanical exhaust option with minimum of one air change every 15 minutes.
- Other equivalent designs.

For SI: 1 foot = 304.8 mm, 1 square foot = 0.093m^2

Standby Power

Standby power is required for:

1. Ventilation and automatic fire detection equipment for smokeproof enclosures.

2. Elevators.

3. Where elevators are provided in a high-rise building for accessible means of egress, fire service access or occupant self-evacuation, the standby power system shall also comply with Sections 1009.4, 3007 or 3008, as applicable

Emergency Power

Emergency power is required for:

1. Exit signs and means of egress illumination

required by Chapter 10.

2. Elevator car lighting.

3. Emergency voice/alarm communications systems.

4. Automatic fire detection systems.

5. Fire alarm systems.

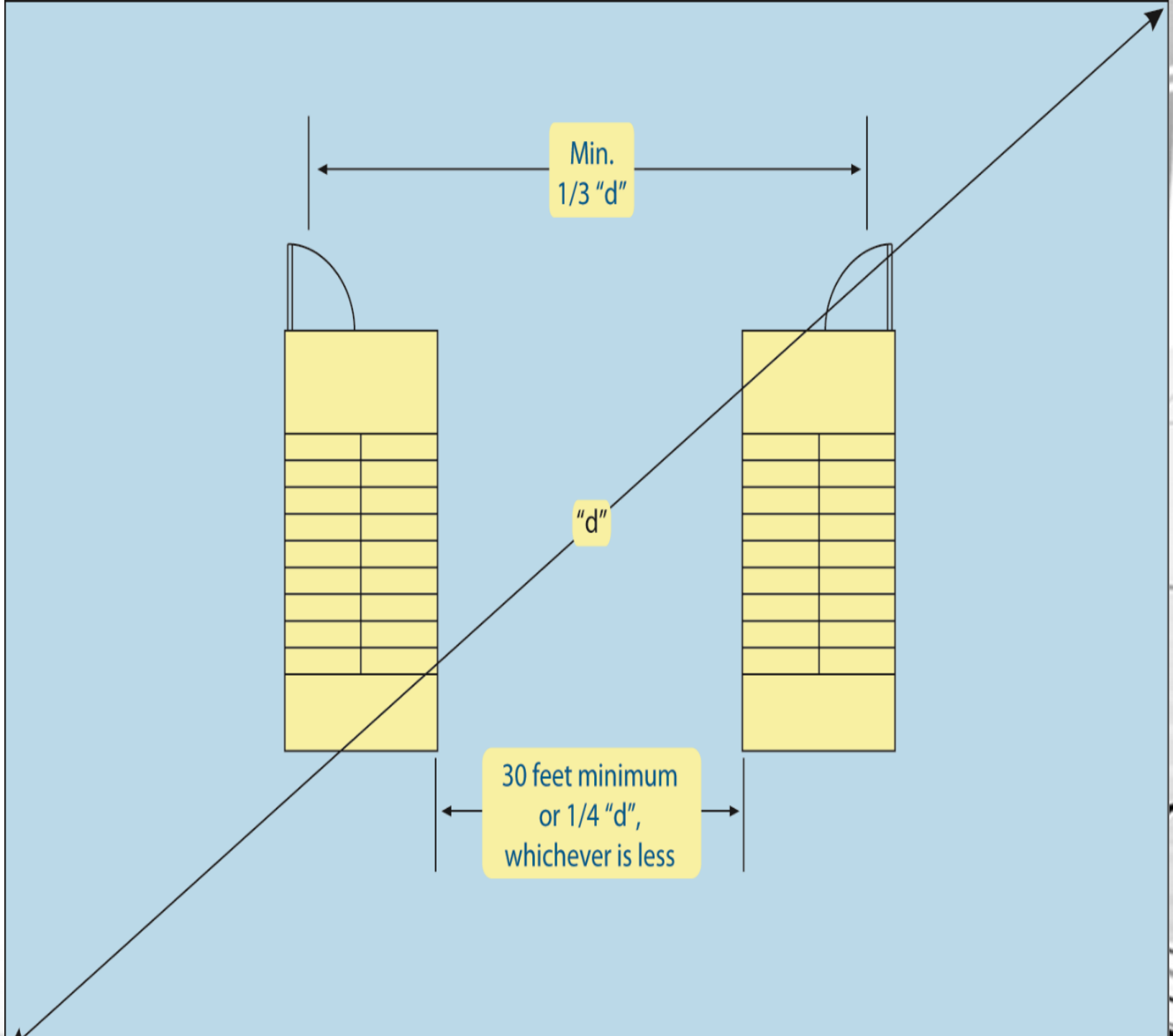
6. Electrically powered fire pumps.

7. Power and lighting for the fire command center required by Section 403.4.6.

Section 403.5.1 Remoteness of Stairways

- In addition to the general provisions for exit separation as established in Section 1007.1.1, required interior exit stairways shall be separated by a distance of at least:
  - 30 feet, or
  - ¼ the length of the maximum overall diagonal dimension
- Measurement must be in a straight line between the nearest points of the enclosures.
- At least two of the stairways must comply.

Section 403.5.1 Remoteness of Stairways



Section 403.5.2 Additional Interior Exit Stairway

- Only required in buildings over 420 feet in height, one additional exit stairway shall be provided in addition to those typically mandated.
  - Not applicable to Group R-2 occupancies
- The total width of any combination of remaining stairways with one removed shall not be less than the total width required by Section 1005.1.
- Requirement not applicable in buildings having elevators used for occupant self-evacuation.

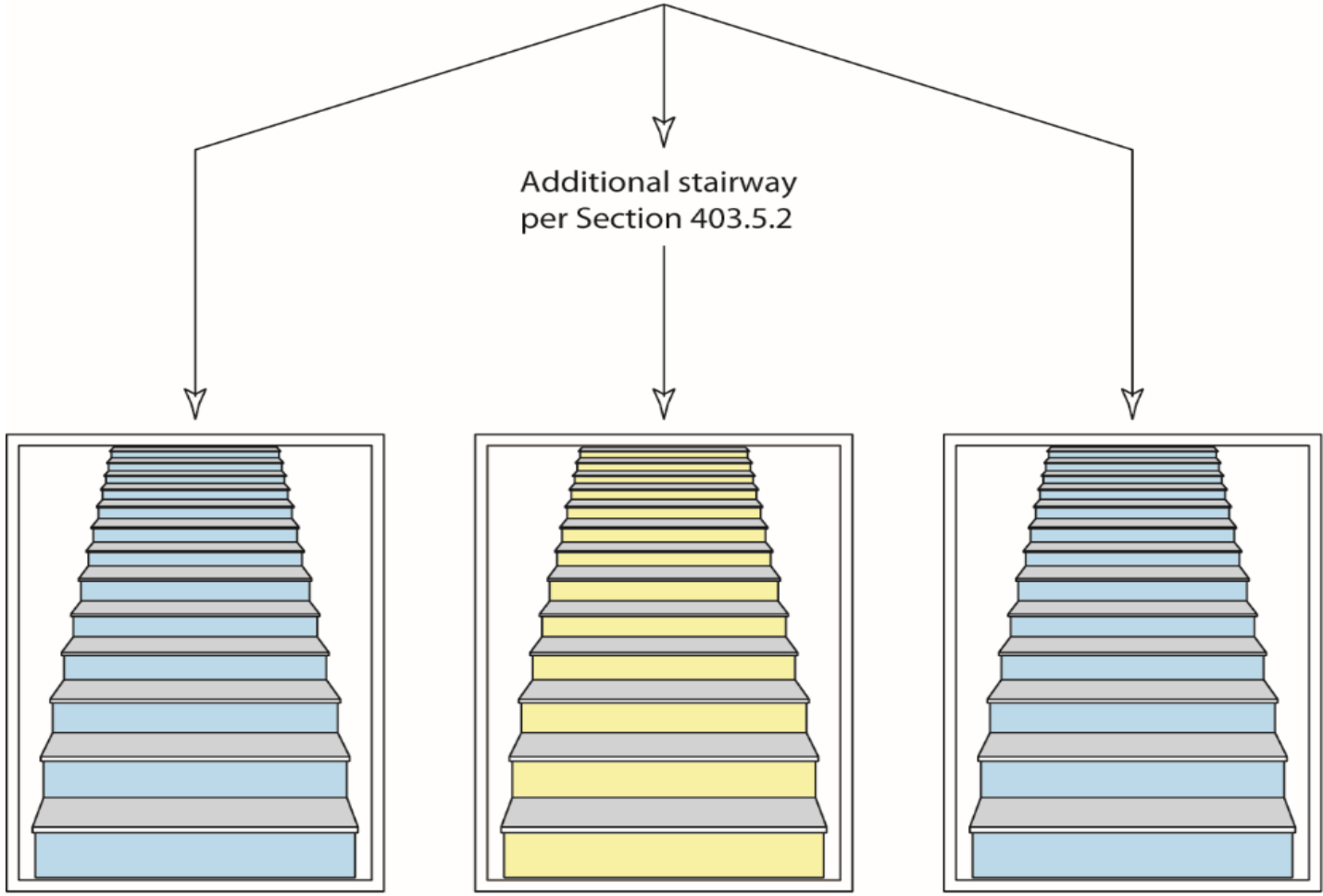
Section 403.5.2 Additional Exit Stairway

Given:

High-rise > 420 feet in height (other than Group R-2)
O.L. of 350 per story
Total required width of 105 inches

Solution (assuming equally sized stairways):

Minimum required stairway
width of 52.5 inches per stairway.



Remoteness of stair enclosures to comply with Section 403.5.1

ADDITIONAL EXIT STAIRWAY

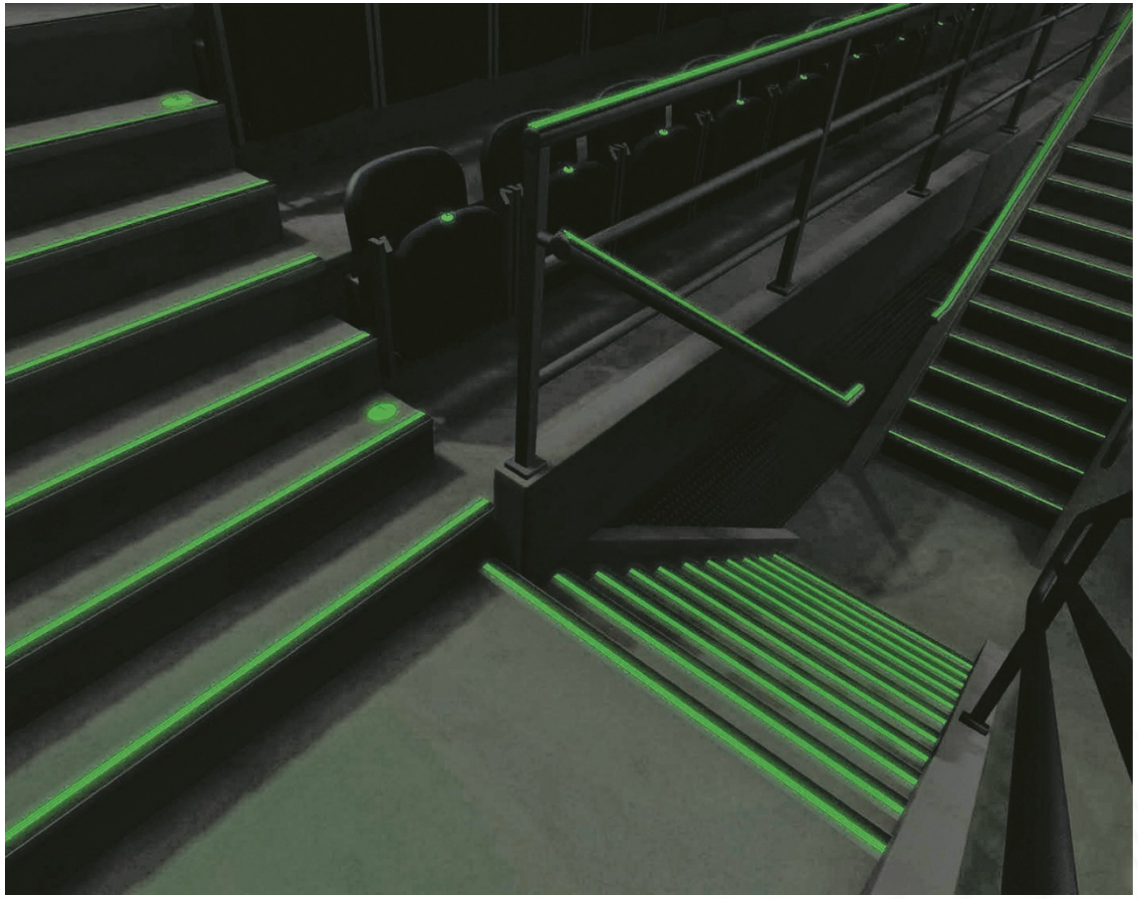
Section 403.5.4 Smokeproof Enclosures

- Where a required stairway serves a floor above the "high-rise" level, it shall be constructed as a smokeproof enclosure.
- The enclosure shall consist of an enclosed interior exit stairway with either an open exterior balcony or a ventilated vestibule.
  - As an option, the balcony or vestibule is not required where the interior exit stairway is pressurized per Section 909.20.5.

Section 403.5.5 Luminous Egress Markings

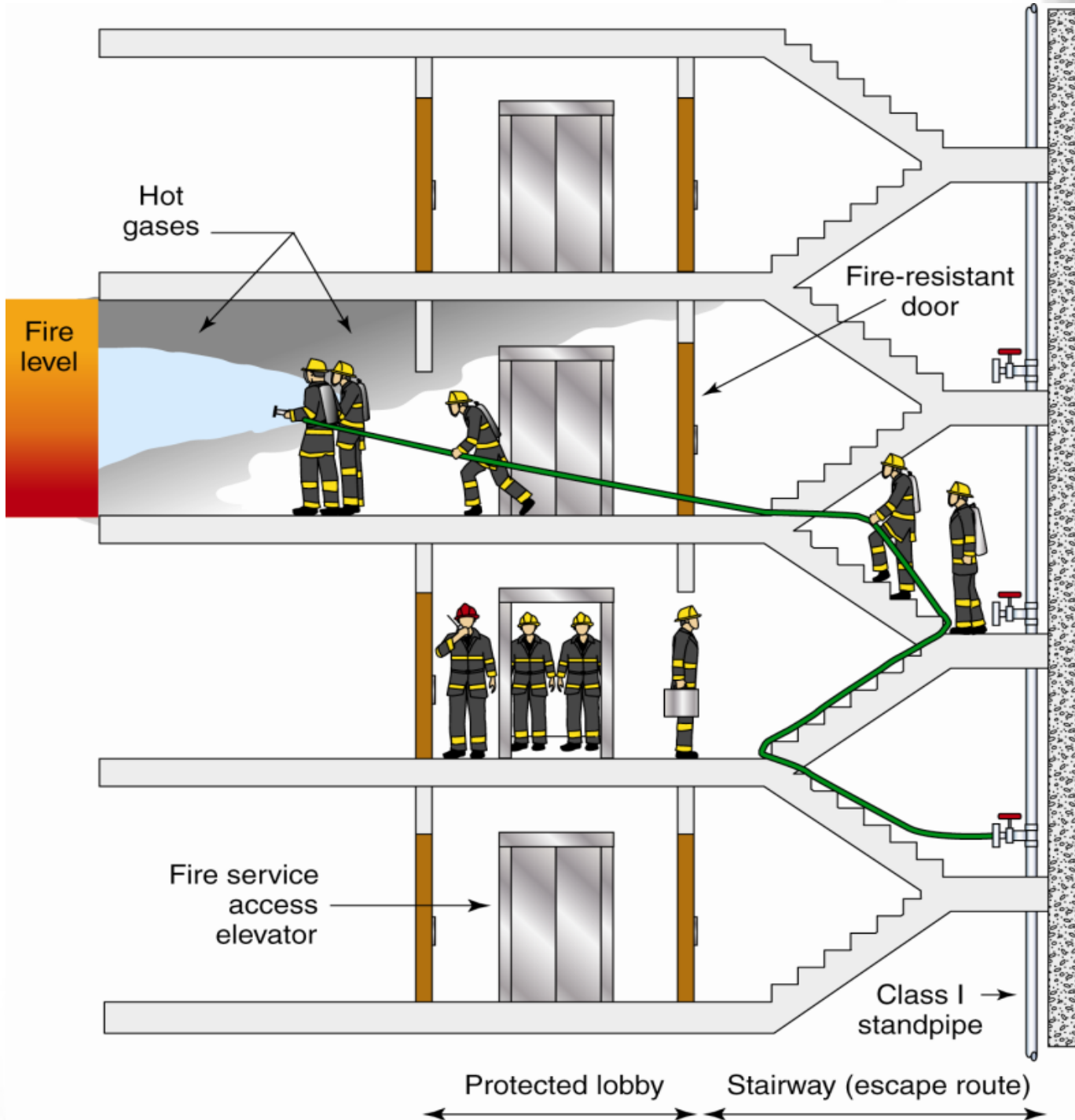
- Approved luminous egress markings are required to delineate the exit paths, other than at the level of exit discharge, in high-rise buildings of Group A, B, E, I - 1, M and R-1 occupancies. Per Section 1025
- The markings shall be provided in interior exit stairway and exit passageways.

Section 403.5.5 Luminous Egress Markings



Section 403.6.1 Fire Service Access Elevators

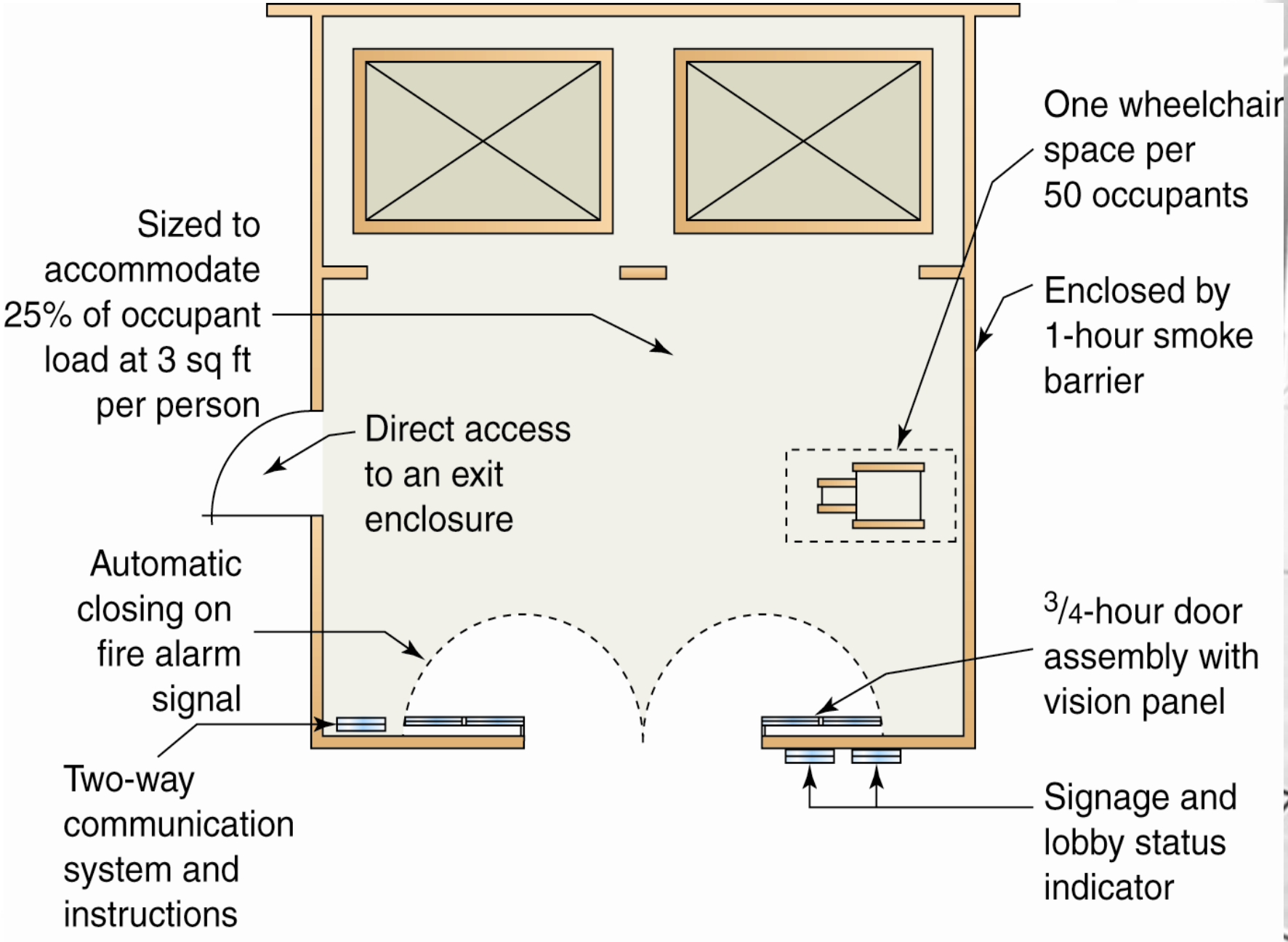
- In buildings with an occupied floor more than 120 feet above the lowest level of fire department vehicle access, at least two fire service access elevators must be provided.



Section 403.6.2 Occupant Evacuation Elevators

- Passenger elevators installed in accordance with Section 3008 are permitted to be used for occupant self-evacuation.
- Where elevators are to be used for self-evacuation, all passenger elevators for general public use shall comply.
- Where occupant evacuation elevators are provided, the additional stairway required by Section 403.5.2 is not required.

Section 403.6.2 Occupant Evacuation Elevators



Occupant evacuation elevator lobby

Atriums

ATRIUM. An opening connecting two or more stories other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. Stories, as used in this definition, do not include balconies within assembly groups or mezzanines that comply with Section 505.

Section 404.1 General Atrium Requirements

- An atrium is a space within a building that extends vertically to connect two or more stories.
  - Atriums are not considered unprotected vertical openings because they are protected by means other than typical floor assemblies or shaft enclosures.
- Atrium provisions do not apply to spaces that comply with any one of the other vertical opening provisions in Section 712 – Vertical Openings.

Section 404.1 General Atrium Requirements

- Atrium provisions are essentially one of several options for regulating vertical openings in horizontal assemblies in buildings.
  - When compliance with the provisions in Section 404 is achieved, other options in Section 712 do not apply.
- Atriums have become a common feature in buildings of all scales and occupancies.
  - They typically function as circulation or lobby space and often include a range of other functions.
  - As with any floor opening atriums provide an increased potential for the spread of smoke and fire between the connected stories.

Section 404.5 Smoke Control

- A mechanical smoke control system is required in all atriums connecting more than three or more stories to prevent the migration of smoke throughout interconnected levels of a building via an atrium.
- The typical method of smoke control in atriums is the exhaust method (Section 909). Smoke control systems are required to be connected to a standby source of power.

Section 404.6 Enclosure of Atriums

- A basic premise of atrium requirements is that an engineered smoke control system combined with a supervised automatic fire sprinkler system provides an adequate alternative to shaft enclosure requirements.
  - Some form of boundary is required to assist the smoke control system in containing smoke to just the atrium area.
  - The basic enclosure requirement separates the atrium space from adjacent areas by fire barriers and horizontal assemblies having a fire-resistance rating of at least 1 hour.
  - Separation is not required for Atriums connecting three or fewer stories.

Section 404.7 Standby Power

- Section 909.11 requires all smoke control systems to be connected to a standby power system.

Section 404.8 Interior Finish

- Interior finishes in atriums can be no less than Class B.
- The presence of a sprinkler system does not allow a reduction of the finish class.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Underground Buildings

Section 405.1 Underground Buildings

- Buildings or portions of buildings that are underground and require occupants of the lowest level to travel upwards for more than 30 feet (9144 mm) to reach the level of exit discharge are regulated as Underground Buildings.

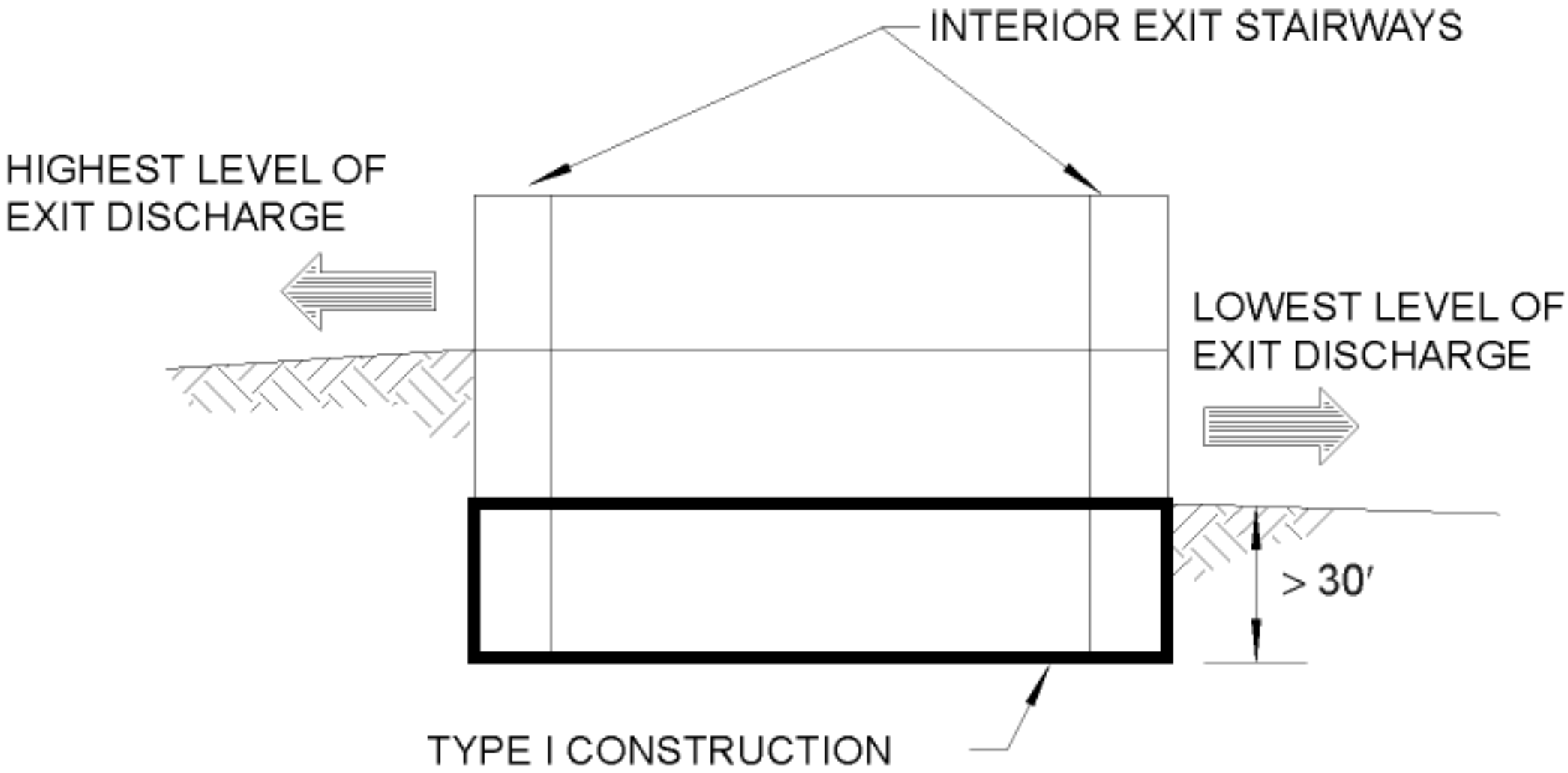
Section 405.1 Underground Buildings

- Underground buildings present unique hazards to life safety.
  - To egress the structure, occupants must travel in an upward direction.
  - The direction of occupant travel is the same as the direction that the products of combustion travel.
  - As such, both the occupants and rescue personnel are potentially exposed to the products of combustion along the entire means of egress.

Section 405.1 Underground Buildings

- The requirements for underground buildings are similar to those for high-rise structures.
- Both types of structures are unusual since they are virtually inaccessible to exterior fire suppression and exterior rescue and have greater potential to trap occupants inside.

Section 405.1 Underground Building Definition



Section 405.1 Exemptions

- The provisions of Section 405 are not applicable to the following buildings:
  - One and two-family dwellings
  - Sprinklered parking garages
  - Subway transit systems
  - Stadiums and arenas
  - Pumping stations
  - Underground buildings with a small floor plate and low occupant load

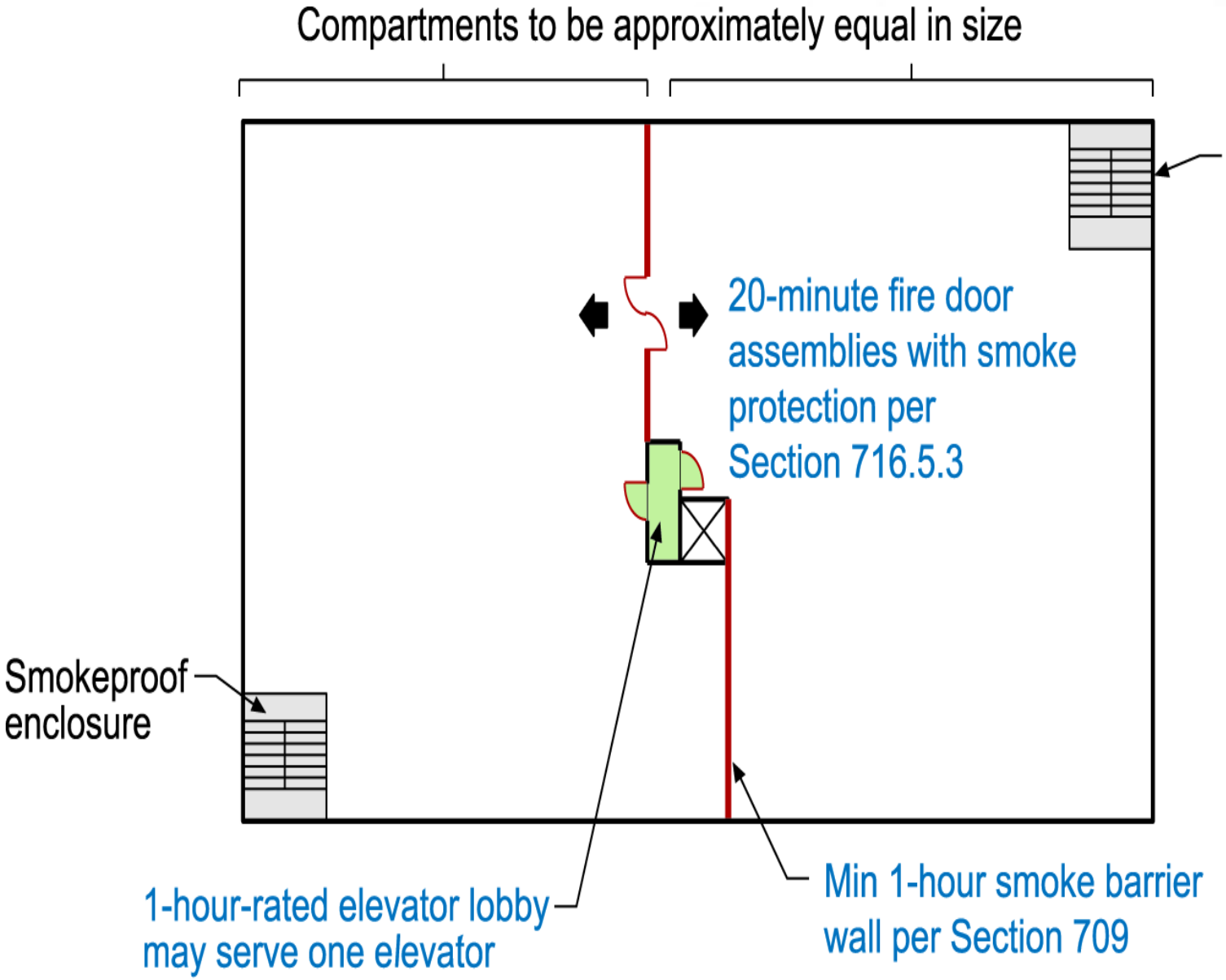
Section 405.2 Construction Requirements

- Type I construction is required for all below-grade levels of an underground building.
- The permitted construction types for the above-grade stories is regulated by the general building limitations of Chapters 5 and 6.

Section 405.4 Compartmentation

- Underground buildings with a floor level more than 60 feet below the level of exit discharge require a minimum of two smoke compartments separated with a smoke barrier (Section 709).
- Compartmentation is required at the level of exit discharge and every level below.
- Compartmentation is a key element for occupant egress and fire fighter access.
  - Compartments allow occupants to travel horizontally to escape a fire and also provide a staging area for the fire service.

Section 405.4 Compartmentation



Applies where occupied floor is more than 60 feet below lowest level of exit discharge

Section 405.5 Smoke Control System

- A smoke control system designed in accordance with Section 909 is required for all underground buildings.
  - The smoke control system is an integral part of the required fire protection systems and is focused on mechanically managing smoke during the period of occupant evacuation.
  - A smoke control system will require some form of compartmentation regardless of whether or not compartmentation is required by Section 405.4.

Section 405.5 Smoke Control System

- The goal of smoke control is to contain smoke and hot gases to the immediate area of origin.
- The most common type of smoke control is a pressurization system where the smoke is managed by maintaining pressure differences across smoke barriers.

Section 405.7 Means of Egress

- A minimum of two exits are required for each level.
- All stairways must be smokeproof enclosures in accordance with Sections 1023.10 and 909.20.
- Each compartment required by Section 405.4 requires direct access to an exit and a second means of egress through an adjoining compartment.

Section 405.8.1 Standby Power

- Full standby power is required for the following building systems:
  - smoke control systems
  - ventilation and automatic fire detection equipment for smokeproof enclosures
  - elevators

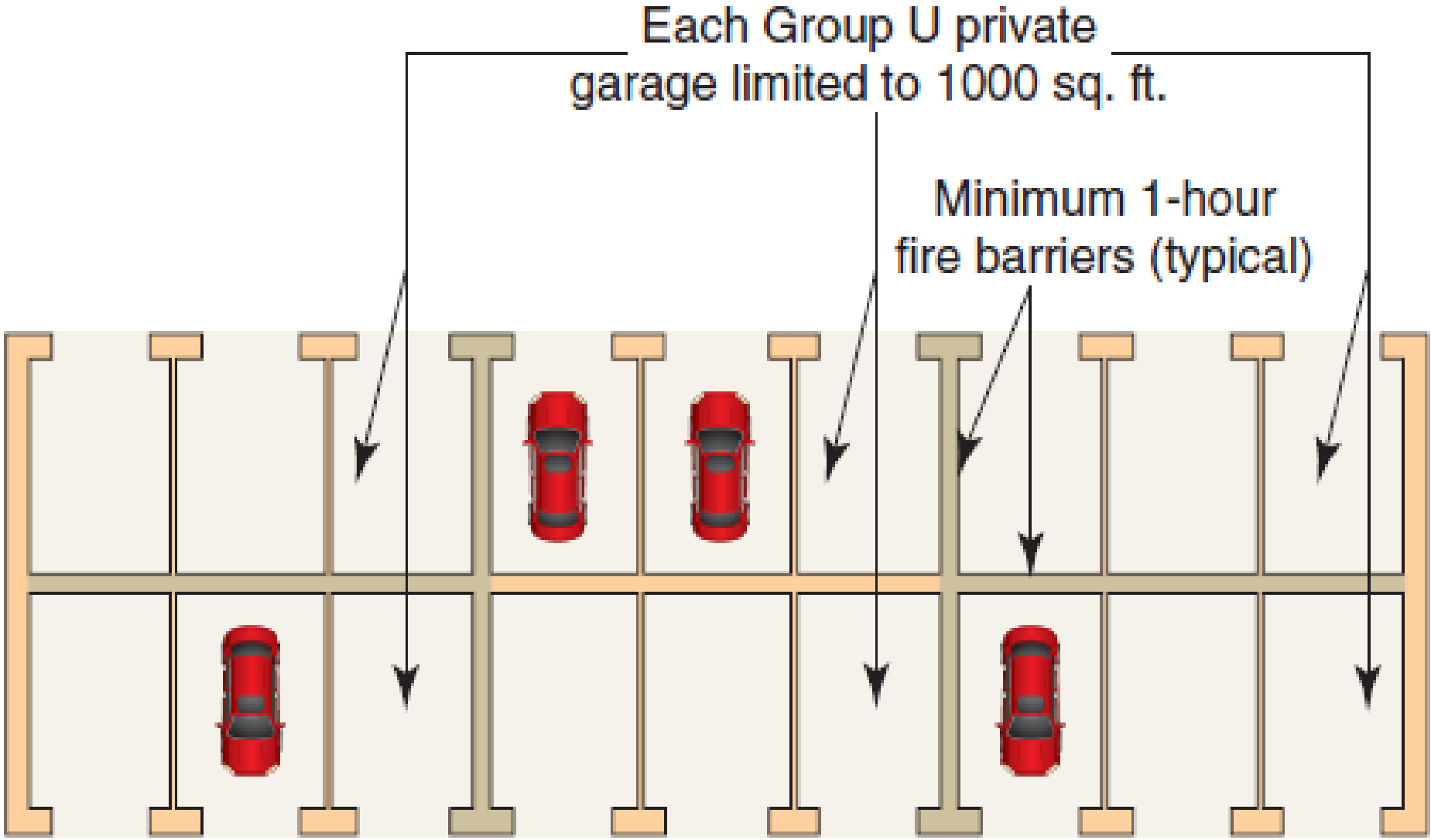
Section 405.9 Emergency Power

- Full emergency power is required for the following building systems:
  - emergency voice/alarm communication
  - fire alarm systems
  - automatic fire detection
  - elevator car lighting
  - means of egress and exit sign illumination
  - fire pumps. (Shifted from standby in 2018 IBC)

Section 406.2 Private Garages and Carports

- Private garages and carports are to be classified as Group U occupancies.
- They are limited in floor area to 1,000 square feet, however, multiple garages are permitted in the same building where each garage is separated from other garages by minimum 1-hour fire barriers.
- Prescriptive separations are established for garages attached to dwelling units.
- Carports must be open on at least 2 sides.

Private Garages and Carports Section 406.2



Example: If non-sprinklered building of Type VB construction, total allowable area limited to 5500 sq. ft. plus any applicable frontage increase

Section 406.4 Public Parking Garages

- Public parking garages, both open and enclosed, are regulated as Group S-2 storage occupancies.
- In addition to the provisions of Section 406, parking garages must also comply with the code provisions for Group S-2 occupancies.

Section 406.4 Public Parking Garages

- Car routes and car parking areas must be at least 7 feet in clear height. Van routes and van parking areas must be at least 8 feet, 2 inches in height.
- Complying guards shall be provided for pedestrians with a minimum height of 42 inches where the drop-off exceeds 30 inches.
- Vehicle barriers a minimum of 33 inches in height are required where the drop-off exceeds 12 inches.

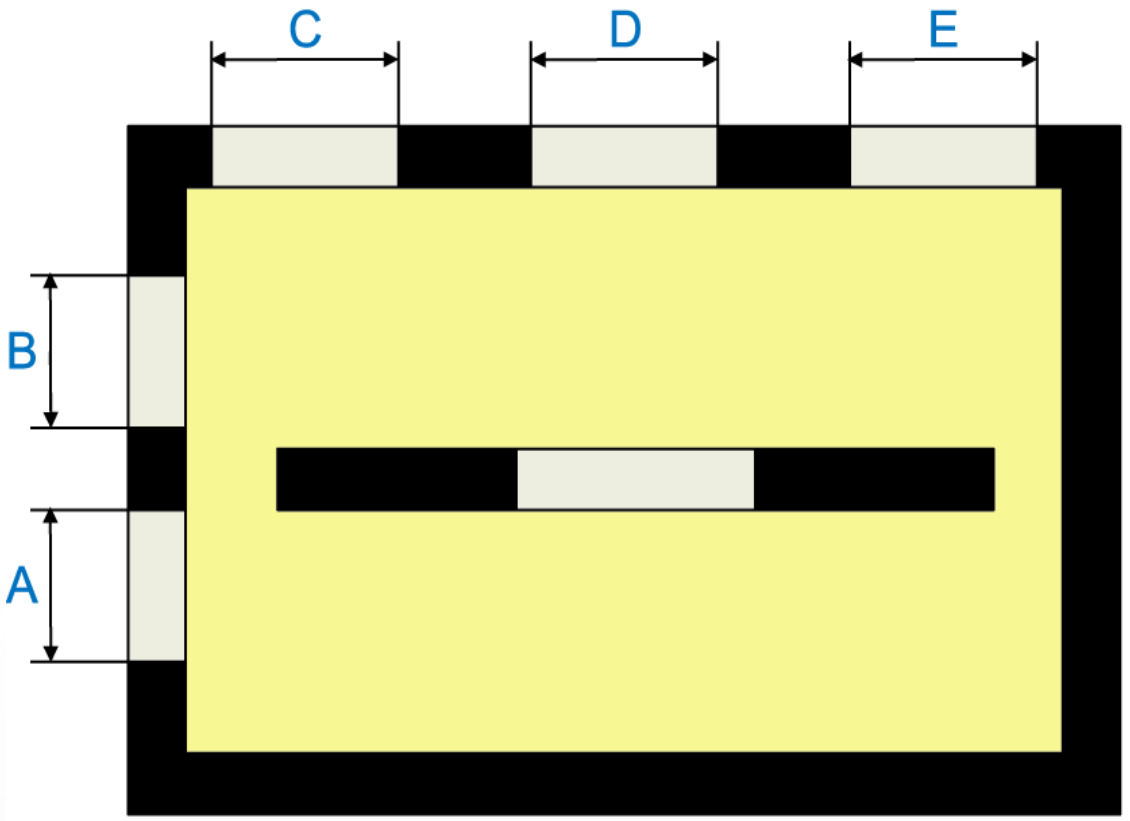
Section 202 Definition of Open Parking Garage Section 406.5

- **OPEN PARKING GARAGE.**
  - A structure or portion of a structure with the openings as described in Section 406.5.2 on two or more sides that is used for the parking or storage of private motor vehicles.

Section 406.5.2 Open Parking Garage Openings

Exterior walls must have uniformly distributed openings on two or more sides

Interior wall and column lines shall be at least 20 percent open (area) with uniformly distributed openings



1. Area:
A + B + C + D + E ≥ 20% total area of each tier

2. Length:
A + B + C + D + E ≥ 40% total perimeter of each tier*

* Minimum of 40 percent not required where required opening uniformly distributed over two opposing sides

General case

Section 406.5.4 Open Parking Garages

- A variety of height and area increases are permitted for single-use open parking garages

TABLE 406.5.4
OPEN PARKING GARAGES AREA AND HEIGHT

TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	HEIGHT (in tiers)		
		Ramp access	Mechanical access	
			Automatic sprinkler system	
			No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	50,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

For SI: 1 square foot = 0.0929 m^2.

Section 406.6 Enclosed Parking Garages

- The general height and area limitations of Chapter 5 apply to parking garages not meeting the minimum openness provisions for open parking garages.
- Mechanical ventilation is required in all enclosed parking garages. (Except those accessory to one and two family dwellings.)
- An automatic sprinkler system is required in enclosed parking garages where:
  - the fire area exceeds 12,000 square feet, or
  - the garage is located beneath other occupancies.

I-2 Occupancy Provisions

Section 407 Group I-2 Occupancies

- **Section 407.1 – General**
- Group I-2 occupancies are those where a significant level of care or supervision is provided for the occupants.
- Some or all of the occupants may not be capable of self-preservation or self-egress.
- Group I-2 facilities include hospitals (medical and psychiatric), nursing homes, detoxification facilities and foster care facilities.

Section 407.3 Corridor Wall Construction

- Group I-2 corridor walls are constructed to form a barrier to limit smoke transfer in accordance with provisions for smoke partitions in Section 710.
- Corridor walls are not required to have a fire-resistance rating, but to resist the passage of smoke, they must continue to the underside of the deck above or to a smoke resistant ceiling membrane.
- Corridor doors are gasketed for smoke resistance but are not required to have closers or fire resistance unless required by other sections (exit enclosures, incidental uses, etc.)

Section 407.4 Means of Egress

- Group I-2 “defend-in-place” strategy protects patients in their rooms until relocation to adjacent smoke compartments and eventual building evacuation if necessary.
- Most habitable rooms in Group I-2 areas are required to have direct access to a corridor.
- Patient rooms within care suites are given specific limitations for intervening rooms and travel distance depending on the nature of the care suite.

407.5 Smoke Barriers

- Refuge areas are portions of a story to which care recipients may be relocated in an emergency.
  - Stories used for sleeping, care or treatment and all others with an occupant load of 50 or more must be divided into at least two smoke compartments.
  - Each smoke compartment is limited to an area of no more than 22,500 square feet (40,000 square feet in Group I-2, Condition 2)
  - The travel distance from any point in a smoke compartment to a smoke barrier door is limited to 200 feet.

NOTE: A smoke barrier has a fire-resistance rating of 1 hour and provides a continuous separation through all concealed spaces (ceilings, wall cavities, etc.) on a story.

Section 407.5 Smoke Barriers

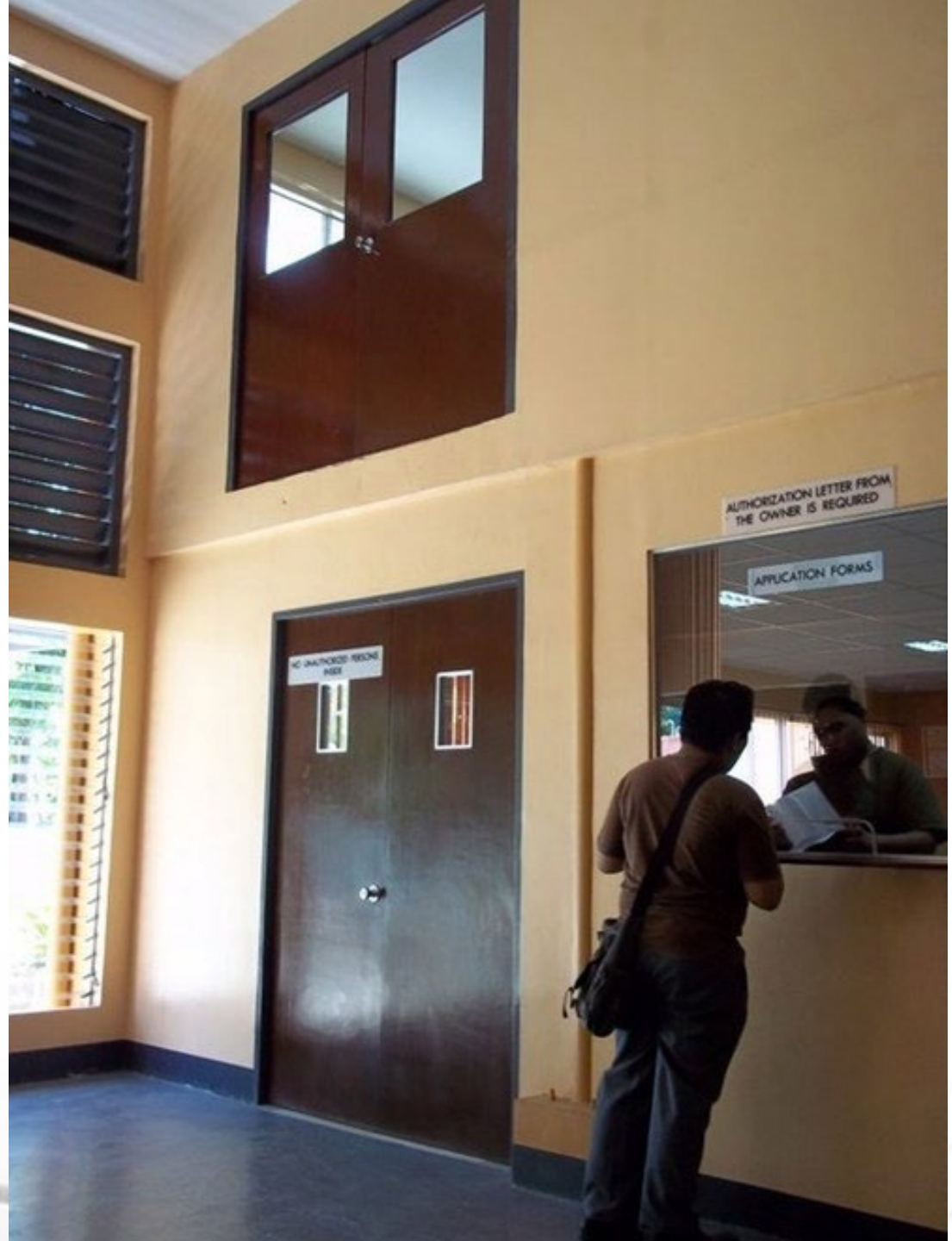
Refuge area.

- Open occupiable space on each side of a smoke barrier must be available.
- Refuge space can be in any area not capable of being locked and not posing a hazard to the evacuees.
- Each ambulatory person requires at least 6 square feet of floor space and each nonambulatory (bed-bound) person requires at least 30 square feet of space.

407.5 Smoke Barriers

Horizontal assemblies.

- Floors supporting smoke barrier walls must also be designed to resist the passage of smoke, thus creating a complete smoke-protected compartment.
- Section 709 is referenced to address openings and penetrations of horizontal assemblies providing a barrier to smoke.

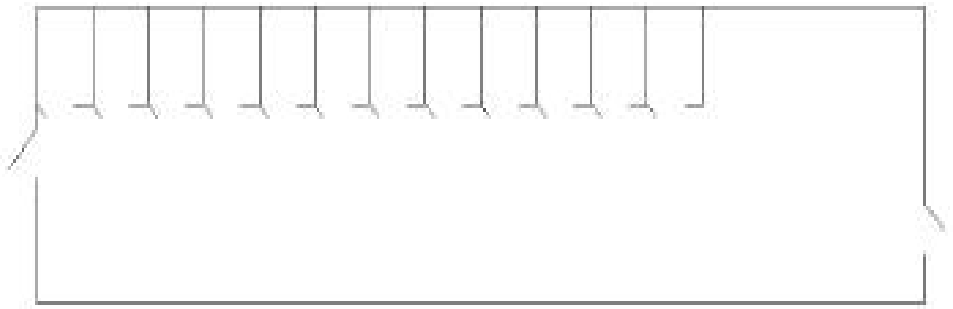

AUTHORIZATION LETTER FROM
THE OWNER IS REQUIRED
APPLICATION FORMS

I-3 Occupancy Provisions

Section 408 Group I-3 Occupancies

- Detention and correctional facilities are categorized as Group I-3.
- Include five levels of security (Occupancy Conditions 1 through 5, Section 308.4) based on the limits of occupant free movement within a particular Group I-3 facility.
- The basic protection features provided include early detection, fire containment, evacuation and fire suppression.

408.1 Group I-3 Occupancy Conditions (from Section 308.5)



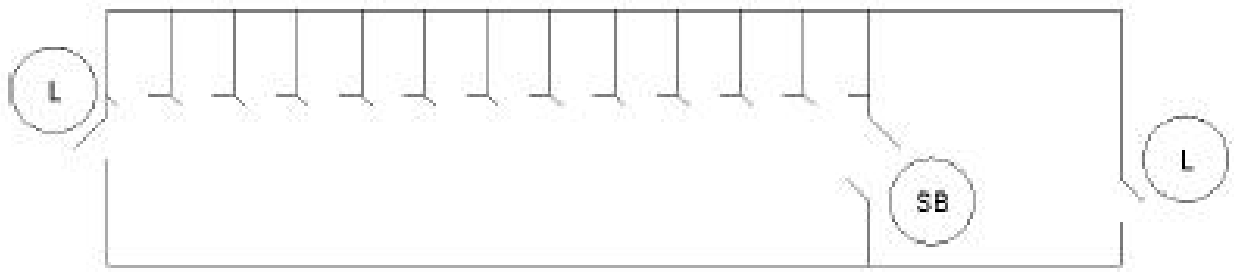
CONDITION 1

Condition 1: Free movement between resident-use areas and to the exterior. Can be constructed as Group R.

DETENTION AND CORRECTIONAL OCCUPANCY CONDITIONS:

- (L) LOCKED
- (RL) LOCKED — REMOTE-CONTROLLED RELEASE OR EQUIVALENT
- (SB) SMOKE BARRIER OR HORIZONTAL EXIT

408.1 Group I-3 Occupancy Conditions (from Section 308.5)



CONDITION 2

DETENTION AND CORRECTIONAL OCCUPANCY CONDITIONS:

L LOCKED

RL LOCKED — REMOTE-CONTROLLED RELEASE OR EQUIVALENT

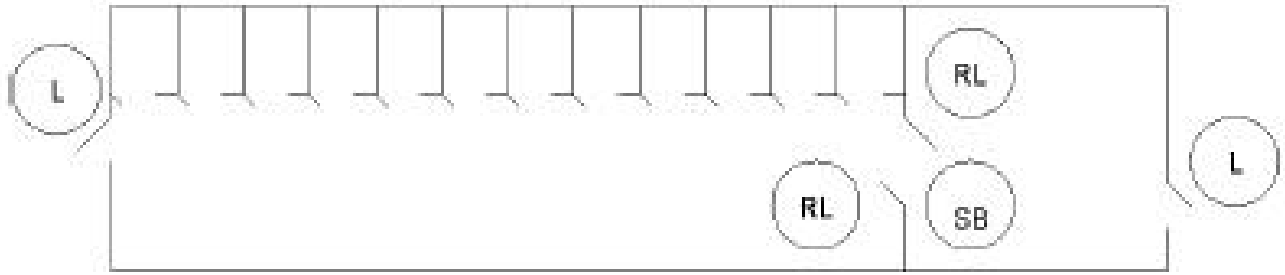
SB SMOKE BARRIER OR HORIZONTAL EXIT

Condition 2: Free movement between sleeping areas and other smoke compartments. Building exits are locked.

408.1 Group I-3 Occupancy Conditions (from Section 308.5)

DETENTION AND CORRECTIONAL OCCUPANCY CONDITIONS:

- L — LOCKED
- RL — LOCKED — REMOTE-CONTROLLED RELEASE OR EQUIVALENT
- SB — SMOKE BARRIER OR HORIZONTAL EXIT



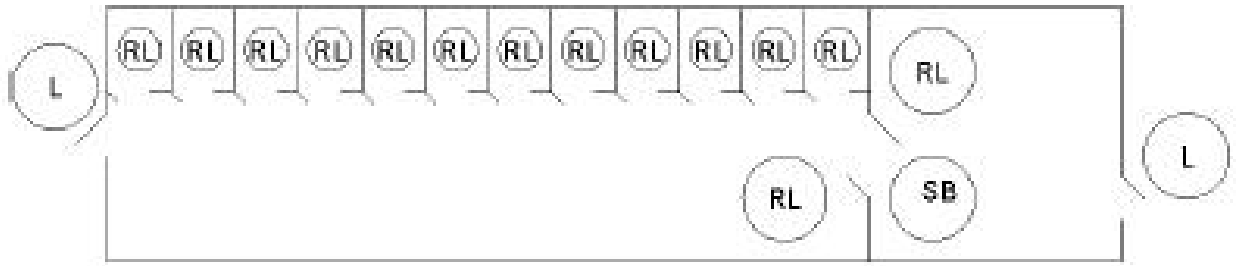
CONDITION 3

Condition 3: Free movement within individual smoke compartments. Remote-controlled between compartments.

408.1 Group I-3 Occupancy Conditions (from Section 308.5)

DETENTION AND CORRECTIONAL OCCUPANCY CONDITIONS:

- L — LOCKED
- RL — LOCKED — REMOTE-CONTROLLED RELEASE OR EQUIVALENT
- SB — SMOKE BARRIER OR HORIZONTAL EXIT



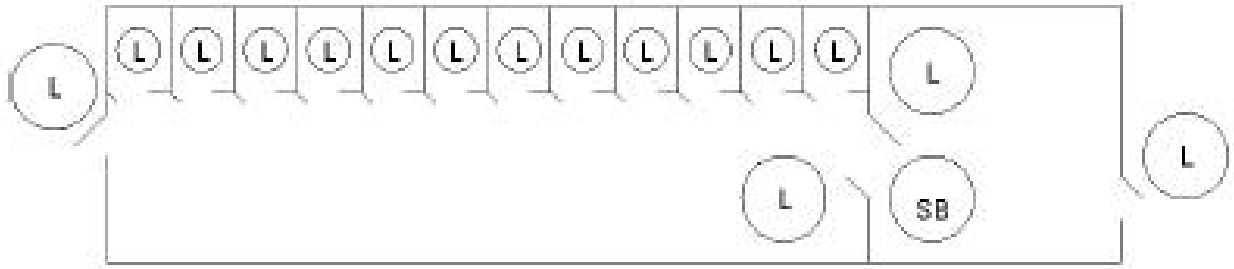
CONDITION 4

Condition 4: Free movement is restricted from occupied spaces. Remote-controlled release between all spaces.

408.1 Group I-3 Occupancy Conditions (from Section 308.5)

DETENTION AND CORRECTIONAL OCCUPANCY CONDITIONS:

- L — LOCKED
- RL — LOCKED — REMOTE-CONTROLLED RELEASE OR EQUIVALENT
- SB — SMOKE BARRIER OR HORIZONTAL EXIT



CONDITION 5

Condition 5: Free movement is restricted from occupied spaces. Staff-controlled manual release between all spaces.

Section 408.4 Locks

- Specific criteria are provided for instances where egress is impeded:
  - **Remote release:** Remote-controlled release, when provided, is usually operated from observation stations.
  - **Power-operated doors and locks:** During a power failure electrically operated sliding doors and electrically operated locks on swinging doors require alternative means for unlocking.

Section 408.5 Protection of Vertical Openings

- Floor opening limitations for incarceration facilities are liberalized for the sake of better visual and audible supervision.
- Concealed spaces in floors, walls, ceilings, shafts, etc., normally used for utilities in other occupancies, are avoided.
- Concealed spaces of any kind in Group I-3 occupancies are problematical.

Section 408.6 Smoke Barrier

- Smoke barrier compartmentation required on stories with sleeping units or where occupant load ≥ 50.
- Travel distance and occupant load within a compartment is limited to 150 feet and 200 persons.
- Six square feet per person must be provided for the combined total number of occupants.
- To prevent dead-end smoke compartments, exits are arranged to permit access without returning through a compartment from which egress originated.

Section 408.7 Security Glazing

- Sprinkler protected glazing in 1-hour fire-resistance rated walls (fire barriers, fire partitions and smoke barriers) in lieu of the normal provisions for opening protectives is allowed.
- Four conditions for the use of such glazing are given.

Section 408.8 Windowless Buildings

- An engineered smoke control system is required for smoke compartments in which there are no openings through which the products of combustion can be vented.
- As defined for this section only, a windowless building is a building or portion thereof having only nonoperable windows, windows that are not readily breakable or totally without windows.

Special Building Features

Many occupancies contain specialized facilities within them. Provisions for these special use areas can include those listed in this module:

409 Motion picture projection rooms,
410 Stages and Platforms,
423 storm shelters and
424 children's play areas.

Section 410 Stages, Platforms and Technical Production Areas

- The provisions of Section 410 are intended to limit the threat to an audience from a stage fire.
- Requirements address construction material restrictions, sprinkler systems, ventilation, separation of the stage from the audience and compartmentation of backstage areas.
- Special allowances are provided for galleries, gridirons, catwalks and other technical production areas.

Section 410 Stages, Platforms and Technical Production Areas

- Hazards associated with stages include:
  - Combustible scenery, suspended lighting and special effects
  - Soft acoustical treatments throughout stage areas
  - Workshops, scene docks and dressing rooms around the stage perimeter
  - Under-stage storage and property rooms.

Section 202 Definitions

- **PLATFORM.** A raised area within a building used for worship, the presentation of music, plays or other entertainment; the head table for special guests; the raised area for lecturers and speakers; boxing and wrestling rings; theater-in-the round stages; and similar purposes wherein there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days.

Section 202 Definitions

- **STAGE.** A space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound.
- **PROSCENIUM WALL.** The wall that separates the stage from the auditorium or assembly seating area.

Section 202 Definitions

- **TECHNICAL PRODUCTION AREAS.** Open elevated areas or spaces intended for entertainment technicians to walk on and occupy for servicing and operating entertainment technology systems and equipment. Galleries, including fly and lighting galleries, gridirons, catwalks, and similar areas are designed for these purposes.

Section 410.2.4 Stage Proscenium Wall

- A minimum two-hour fire-resistance-rated proscenium wall is required where the stage height is greater than 50 feet.
- Stages with a height less than 50 feet do not require separation from the audience since they have a lesser fuel load potential from scenery, drops and curtains.

Section 410.2.5 Stage Proscenium Curtain

- The proscenium opening must be protected with either a fire curtain or a water curtain.
- A curtain is not required where a smoke control system or natural ventilation is provided.
  - The special smoke-protected assembly seating allowances for the egress system are not permitted to be applied.
  - The smoke level shall be maintained at least 6 feet above the floor of the means of egress.
- Horizontal sliding doors are also permitted if they have a minimum fire protection rating of 1-hour.

Section 410.2.7 Stage Ventilation

- Stages larger than 1,000 square feet in area, or with a height greater than 50 feet, must have emergency ventilation to control smoke.
- Roof vents, when used, must open automatically by heat activated devices with supplemental manual means.

Section 410.3 Platform Construction

- Permanent platforms are required to be of Type I, II or IV construction.
  - Platforms are permitted to be constructed of fire-retardant-treated wood when they are:
    - no more than 30 inches above the main floor, and
    - no more than one-third of the floor area of the room, and
    - no more than 3,000 square feet in area.
- Temporary platforms may be constructed of any approved material.
- The space beneath a temporary platform may not be used for any purpose other than electrical wiring or plumbing to the platform equipment.

Section 410.4 Dressing and Appurtenant Rooms

- Backstage rooms, including dressing rooms, storage rooms, prop rooms and shop rooms, must be separated from the stage and from each other.
  - Separation from stage where stage height exceeds 50 feet: 2-hour fire barriers and/or horizontal assemblies.
  - Separation from stage where stage height is 50 feet or less: 1-hour fire barriers and/or horizontal assemblies.
  - Separation from each other: 1-hour fire barriers and/or horizontal assemblies.

Section 202 Definition of Special Amusement Building

SPECIAL AMUSEMENT BUILDING.

- A special amusement building is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and that contains a device or system that conveys passengers or provides a walkway along, around or over a course in any direction so arranged that the means of egress path is not readily apparent due to visual or audio distractions or is intentionally confounded or is not readily available because of the nature of the attraction or mode of conveyance through the building or structure.

Section 411 Special Amusement Buildings

- Enclosed special amusement buildings with an occupant load of 50 or more shall be classified as a Group A occupancy.
- Where the occupant load is less than 50, a Group B classification is warranted.
- These provisions apply in addition to the other requirements for the appropriate assembly use, usually Group A-1 or A-3.
- All flammable decorative materials used in special amusement buildings are required to follow the provisions of the International Fire Code (IFC).

Section 411 Special Amusement Buildings

- Section 411 does not apply to a facility without a roof or enclosing walls, such as outdoor mazes and similar seasonal facilities.
- Free and immediate ventilation of smoke eliminates the primary hazard associated with enclosed special amusement buildings, that egress is not readily apparent or intentionally confusing.

Section 411.2 Automatic Fire Detection

- An automatic fire detection system is required to provide early warning of fire.
- The fire detection system is required regardless of the presence of numerous staff in the building.

Section 411.3 Automatic Sprinkler System

- Special amusement buildings require an automatic sprinkler system, except
  - where the building is less than 1,000 square feet, and
  - the travel distance to exits is less than 50 feet, and
  - the facility is used only on a temporary basis.

Section 411.4 Alarm

- Section 907.2.11 provides special provisions for special amusement buildings.
- The activation of any single fire detection device or sprinkler head must cause an alarm to be sounded at a constantly attended location.
- Staff then shall initiate the process of providing egress illumination, stopping all confusing sounds and distractions, activating the lighted exit markings, and preventing additional persons from entering the facility.
- Activation of two or more devices requires automatic activation of these safety features.

Section 411.5 Emergency Voice/Alarm Communications System

- An emergency voice/alarm communication system (EV/AC) must be provided.
  - The EV/CS may serve as a public address system to alert the building occupants of an emergency and provide them with instructions.
- The system must be installed in accordance with NFPA 72 and must be heard throughout the entire special amusement building.

Section 411.6 Exit Marking

- In addition to the normally required exit signs, approved directional exit markings shall also be provided.
- Where the path of egress travel is intentionally not apparent, complying low-level exit signs and directional markings are required.
  - Floor-proximity directional markings and exit signage may be dimmed provided they become immediately visible in an emergency.

Section 411.7 Interior Finish

- Due to the potential for fire to spread quickly in the relatively confined spaces in these structures, only Class A materials are permitted to be used as interior finishes.
- Special amusement buildings are not permitted finish classification reductions normally allowed by Table 803.11 for sprinklered buildings.

Section 412 Aircraft-Related Occupancies

- Section 412 provides specific details for the construction of the full range of aircraft-related occupancies, from residential aircraft hangars to those handling large commercial aircraft, as well as aircraft manufacturing facilities, airport traffic control towers, aircraft paint hangars, helistops and heliports.
- These structures pose unique hazards to occupants because of their extreme height and limited routes of escape.
- This section contains requirements governing the permitted types of construction and necessary egress along with the needed fire protection systems.

Section 412.3.1 Aircraft Hangar Exterior Walls

- Exterior walls shall have a minimum 2-hour fire-resistance rating where located less that 30 feet from lot lines and public ways.
  - Measurement not necessarily related to fire separation distance
  - Provision not applicable to opposing walls of hangars where two or more hangars occur on same lot, however, other applicable provisions still apply:
    - NFPA 409 addresses clusters of hangars
    - IBC Sections 503.1.2 and 705.3 address multiple hangars on the same lot

Section 412.3.6 Aircraft Hangar Fire Suppression

- Aircraft hangars shall be provided with a fire suppression system in accordance with NFPA 409, based upon the classification for the hangar as given in Table 412.4.6.
- The classification as Group I, II or III is based upon the fire area size and the building's type of construction.

Unique Considerations for Occupancies Where People Sleep

Section 420 Group I-1, R-1, R-2, R-3 and R-4 Occupancies

- The nature of occupancies in this section are such that some level of protection against fire is needed for occupants due to a high frequency of fires in buildings where people live and sleep.

Section 420.2 Separation Walls

- Sleeping units and/or dwelling units that are in a single building are required to be separated from each other and from other portions of the building by fire partitions (walls) complying with Section 708.
- Separation to be minimum 1-hour fire-rated.
  - Minimum ½-hour rating required where building is of Type IIB, IIIB or VB construction and sprinklered with NFPA 13 system.

Section 420.3 Horizontal Separation

- Section 711.2.4.3 requires floor assemblies to be not less than 1-hour fire-resistance rated.
- If the building's sprinkler protection is provided by a system complying with NFPA 13, the rating can be reduced to 30 minutes.
- Section 708.4 (Fire Partitions - Continuity) requires 1-hour-rated fire partitions to be supported by construction with the same or better rating but this requirement is waived for in buildings of Type IIB, IIIB and VB construction.

Section 202 Definition of Ambulatory Care Facility

- AMBULATORY CARE FACILITY. Buildings or portions thereof used to provide medical, surgical, psychiatric, nursing or similar care on a less than 24-hour basis to individuals who are rendered incapable of self-preservation by the services provided.

Section 422 Ambulatory Care Facilities

- The code identifies medical care Group I occupancies as having 24-hour stay.
- Without a 24-hour stay, these care facilities are classified as Group B.
- Simply regulating surgery centers and similar care facilities as typical Group B occupancies is considered inappropriate, as this would allow the rendering of any number of care recipients as incapable of self-preservation with no more protection than a business office.

Section 422 Ambulatory Care Facilities

- Ambulatory care facilities contain distinctly different hazards to life and safety:
  1. Persons incapable of self-preservation require rescue by other occupants or fire personnel.
  2. Medical staff must stay with each patient; therefore, staff may require assistance as well.
  3. Use of oxidizing medical gases, such as oxygen and nitrous oxide.
  4. Prevalence of surgical fires.

Key Subsections of Ambulatory Care Facilities:

- 422.2 Separation.
- 422.3 Smoke compartments.
- 422.4 Automatic sprinkler systems.
- 422.5 Fire alarm systems

Section 423 Storm Shelters

- The *ICC/NSSA Standard for the Design and Construction of Storm Shelters* (ICC-500-2014) provides requirements for shelters to protect people from the violent winds of hurricanes and tornadoes.

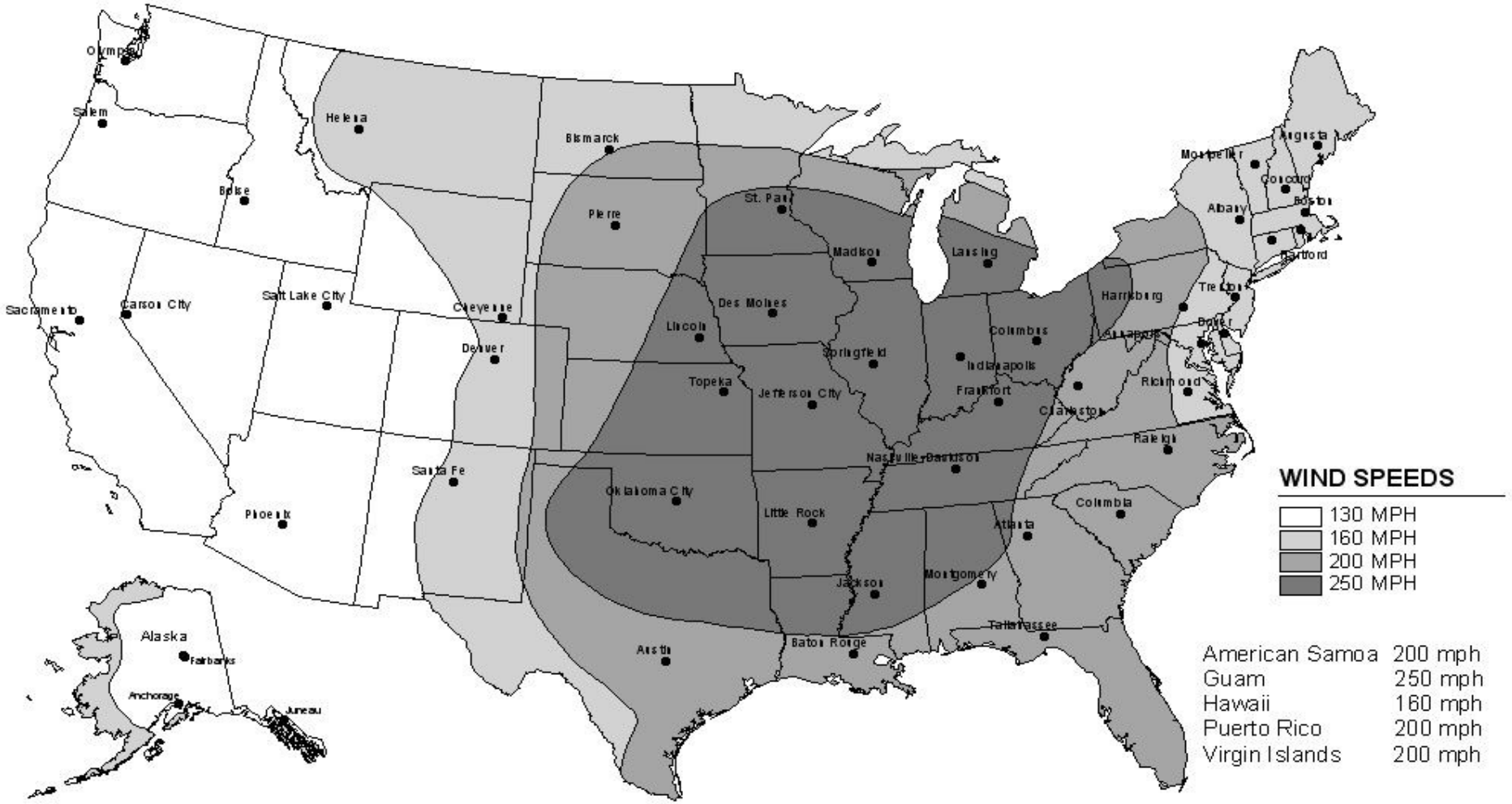
Section 202 Definitions

- **STORM SHELTER.**
  A building, structure or portions thereof, constructed in accordance with ICC 500 and designated for use during a severe wind storm event, such as a hurricane or tornado.
- **COMMUNITY STORM SHELTER.** A storm shelter not defined as a "Residential Storm Shelter."
- **RESIDENTIAL STORM SHELTER.** A storm shelter serving occupants of dwelling units and having an occupant load not exceeding 16 persons.

Section 423 Scope

- Storm shelters may be constructed as separate detached buildings or as safe rooms within a larger facility.
- Storm shelters are required in areas where the shelter design wind speed for tornadoes is 250 MPH in:
  - Critical emergency operations facilities
  - Group E occupancies, with exceptions.

ICC 500 Shelter Design Wind Speed Map



Notes:

1. Values are nominal three-second gust wind speeds in miles per hour at 33 feet above ground for Exposure Category C.
2. Multiply miles per hour by 0.447 to obtain meters per second.

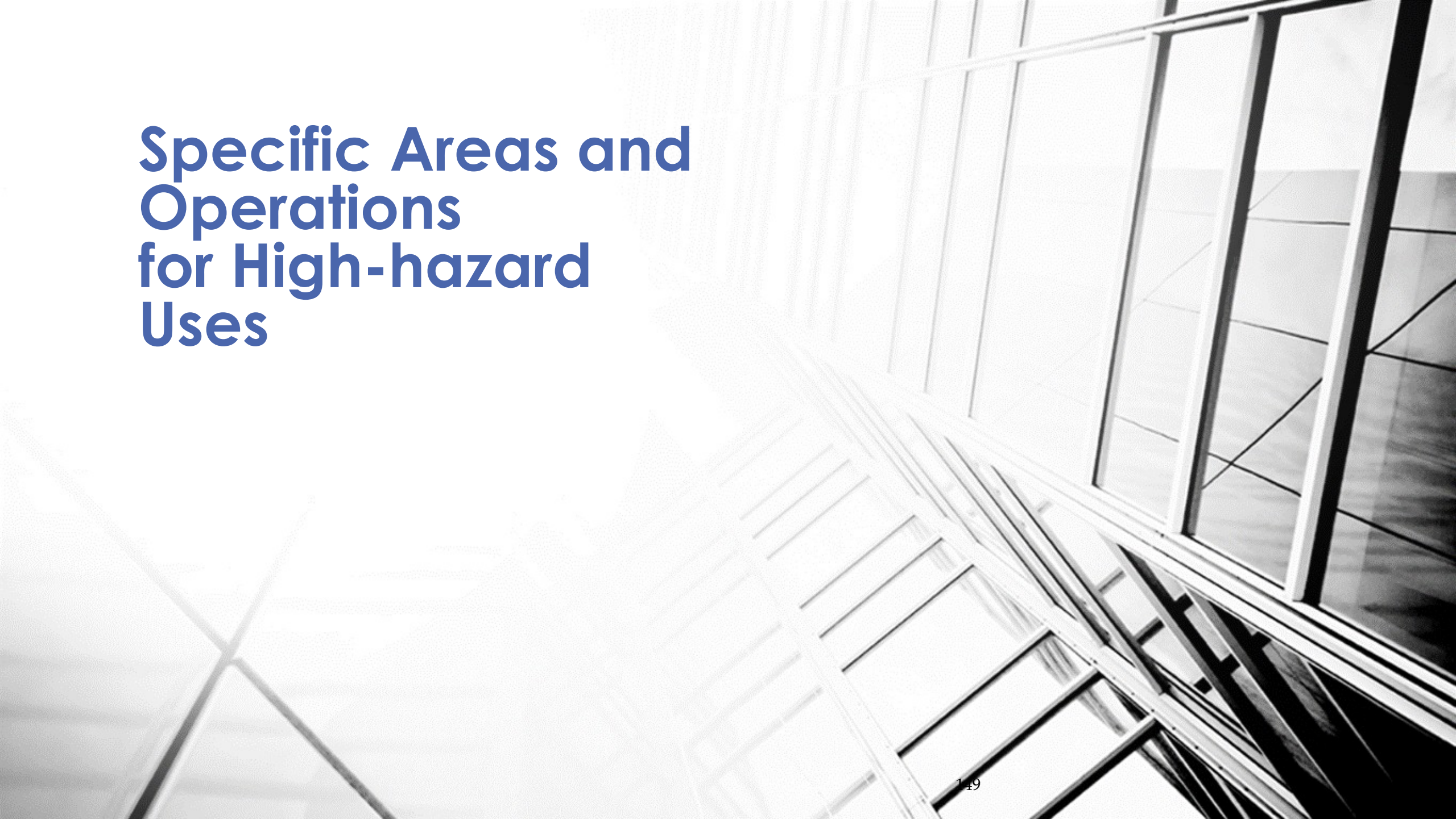
Section 423.3 Critical Emergency Operations

- Facilities regulated include:
  - 911 call stations
  - Emergency operation centers
  - Fire, rescue, ambulance and police stations
- Exception to individual space used as shelter where entire building is designed as storm shelter

Section 423.4 Group E Occupancies

- Provision applies to all Group E occupancies except:
  - Group E day care facilities
  - Group E occupancies accessory to places of religious worship
  - Where entire structure designed as shelter.
- Shelter designed to house 100% of occupant load of the Group E occupancy based on Usable Floor Area as established in ICC 500

Specific Areas and Operations for High-hazard Uses



High-hazard Uses

- The IBC and IFC define a hazardous material as either a physical hazard or a health hazard. In reality, many hazardous materials can be both.
  - For example, **anhydrous chlorine**, a liquefied compressed gas commonly used for disinfecting water, for the manufacturing of paper, and as an ingredient in chlorinated plastics.
  - It is classified as an oxidizing, corrosive and toxic liquefied compressed gas.
  - Anhydrous chlorine has physical and health hazards that are regulated by the IFC and IBC.

High-hazard Uses

- The IBC and IFC regulate hazardous materials whether they are either usable or waste.

- Hazardous waste materials can present greater challenges because changes in the formulation of the waste can change the hazards of the material.

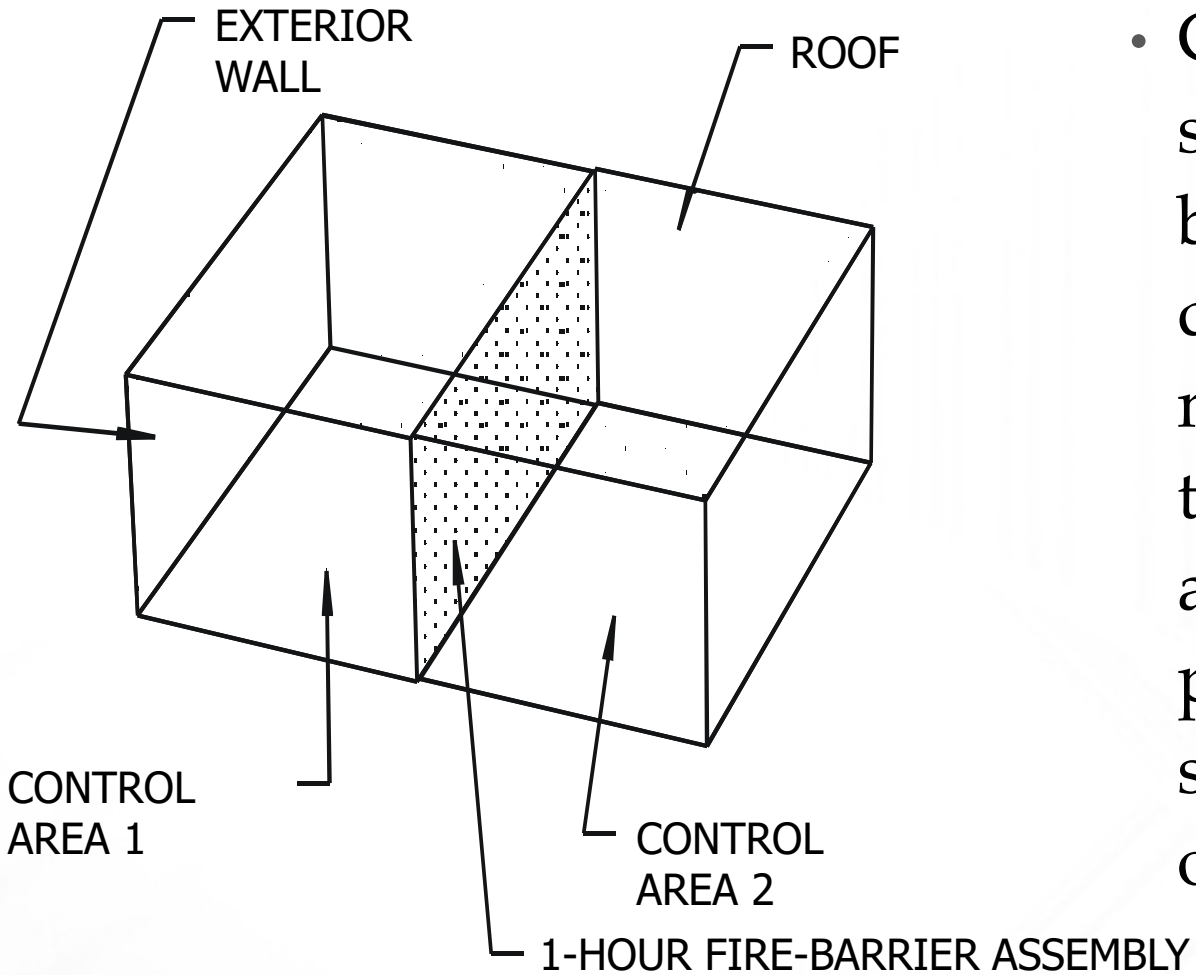
Section 414 Hazardous Materials

- Along with IBC Sections 307 (High-hazard Group H) and 415 (Groups H-1, H-2, H-3, H-4 and H-5), and the IFC, Section 414 is intended to provide companion provisions for the treatment of occupancies that contain hazardous materials.
  - Any building or structure utilizing hazardous materials, regardless of quantity, is to comply with all of the applicable provisions of both the IBC and the IFC.

Section 414 Hazardous Materials

- Design alternatives are provided for the use and storage of hazardous materials without classifying the building as a high-hazard Group H occupancy through the use of:
  - Control Areas (Section 414.2)
  - Group M Display and Storage Option and Grtoup S Storage Areas (Section 414.2.5)
- Construction-related provisions for the five Group H occupancies are contained in Section 415.

Section 414.2 Control Areas



- Control areas are spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled.

Section 414.2 Control Areas

- The intent of the control area concept is to provide an alternative method for the handling of hazardous materials without classifying the occupancy as Group H.
  - In order to not be considered Group H, the amount of hazardous materials within any single control area bounded by fire barriers, horizontal assemblies, fire walls and exterior walls cannot exceed the maximum allowable quantity for a specific material listed in Table 307.1(1) or 307.1(2).

Section 414.2 Control Areas

- A control area may be an entire building or a portion thereof.
- Note that when an entire building is the control area, the entire maximum allowable quantity of material from Table 307.1(1) or 307.1(2) located on any story is subject to the limitations of Table 414.2.2.

Table 414.2.2 Design and Number of Control Areas

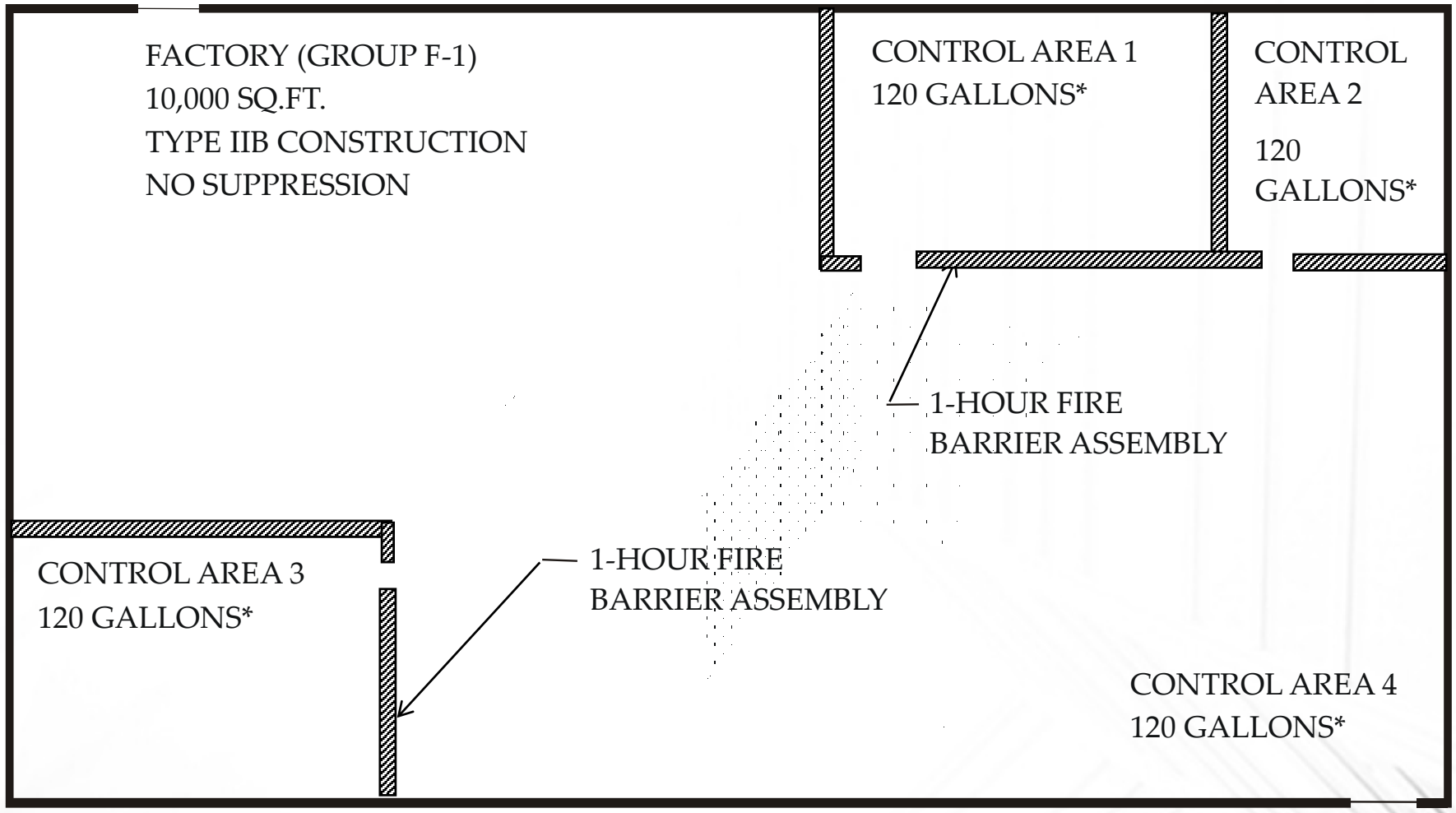
[F] TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA[a]	NUMBER OF CONTROL AREAS PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS[b]
Above grade plane	Higher than 9	5	1	2
	7-9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade plane	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the notes to those tables.

b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.

Section 414.2.2 Control Areas



* ASSUME CLASS IB FLAMMABLE LIQUIDS

Table 307.1(1) Physical Hazard MAQ's per Control Area (partial)

[F] TABLE 307.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible dust	N/A	H-2	Note q	N/A	N/A	Note q	N/A	N/A	Note q	N/A
Combustible liquid[c, i]	II IIIA IIIB	H-2 or H-3 H-2 or H-3 N/A	N/A	120[d, e] 330[d, e] 13,200[e, f]	N/A	N/A	120[d] 330[d] 13,200[f]	N/A	N/A	30[d] 80[d] 3,300[f]
Combustible fiber	Loose Baled[o]	H-3	(100) (1,000)	N/A	N/A	(100) (1,000)	N/A	N/A	(20) (200)	N/A
Consumer fireworks	1.4G	H-3	125[d, e, l]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cryogenics, flammable	N/A	H-2	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Cryogenics, inert	N/A	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
Cryogenics, oxidizing	N/A	H-3	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4G Division 1.5 Division 1.6	H-1 H-1 H-1 or H-2 H-3 H-3 H-1 H-1	1[e, g] 1[e, g] 5[e, g] 50[e, g] 125[d, e, l] 1[e, g] 1[d, e, g]	(1)[e, g] (1)[e, g] (5)[e, g] (50)[e, g] N/A (1)[e, g] N/A	N/A N/A N/A N/A N/A N/A N/A	0.25[g] 0.25[g] 1[g] 50[g] N/A 0.25[g] N/A	(0.25)[g] (0.25)[g] (1)[g] (50)[g] N/A (0.25)[g] N/A	N/A N/A N/A N/A N/A N/A N/A	0.25[g] 0.25[g] 1[g] N/A N/A 0.25[g] N/A	(0.25)[g] (0.25)[g] (1)[g] N/A N/A (0.25)[g] N/A
Flammable gas	Gaseous Liquefied	H-2	N/A	N/A (150)[d,e]	1,000[d,e] N/A	N/A	N/A (150)[d,e]	1,000[d,e] N/A	N/A	N/A
Flammable liquid[c]	1A 1B and 1C	H-2 or H-3	N/A	30[d, e] 120[d, e]	N/A	N/A	30[d] 120[d]	N/A	N/A	10[d] 30[d]
Flammable liquid, combination (1A, 1B, 1C)	N/A	H-2 or H-3	N/A	120[d, e, h]	N/A	N/A	120[d, h]	N/A	N/A	30[d, h]

(continued)

Table 307.1(2) Health Hazard MAQ's per Control Area

[F] TABLE 307.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIAL POSING A HEALTH HAZARD[a, b, c, i]

MATERIAL	STORAGE[d]			USE-CLOSED SYSTEMS[d]			USE-OPEN SYSTEMS[d]	
	Solid pounds (cubic feet)	Liquid gallons (pounds)[e, f]	Gas (cubic feet at NTP)[e]	Solid pounds[e]	Liquid gallons (pounds)[e]	Gas (cubic feet at NTP)[e]	Solid pounds[e]	Liquid gallons (pounds)[e]
Corrosive	5,000	500	Gaseous 810[f] Liquefied (150)[h]	5,000	500	Gaseous 810[f] Liquefied (150)[h]	1,000	100
Highly toxic	10	(10)[h]	Gaseous 20[g] Liquefied (4)[g,h]	10	(10)[i]	Gaseous 20[g] Liquefied (4)[g,h]	3	(3)[i]
Toxic	500	(500)[h]	Gaseous 810[f] Liquefied (150)[f,h]	500	(500)[i]	Gaseous 810[f] Liquefied (150)[f,h]	125	(125)

For SI: 1 cubic foot = 0.028 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. For use of control areas, see Section 414.2.
b. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics, containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
c. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
d. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
e. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1. Where Note f also applies, the increase for both notes shall be applied accumulatively.
f. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the *International Fire Code*. Where Note e also applies, the increase for both notes shall be applied accumulatively.
g. Allowed only when stored in approved exhausted gas cabinets or exhausted enclosures as specified in the *International Fire Code*.
h. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.
i. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the *International Fire Code*.

Section 414.5 Inside Storage, Dispensing and Use

- One or more of these systems may be required for the inside storage and use of hazardous materials:
  - Explosion control
  - Monitored control equipment
  - Emergency or standby power
  - Spill control, drainage and containment

414.6 Outdoor Storage, Dispensing and Use

- Must be in accordance with the provisions of the IFC.
- The outdoor storage or use of hazardous materials in excess of the maximum allowable quantities does not result in a high-hazard occupancy classification but simply dictates the need for additional requirements.

Section 415 Groups H-1, H-2, H-3, H-4 and H-5

Scope

- Establishes the application of Section 415 and references the International Fire Code (IFC) for additional specific hazardous material requirements.
  - Section 415 is only applicable when the MAQ of a hazardous material listed in either Table 307.1(1) or 307.1(2) is exceeded and a Group H classification is warranted.
  - Section 414 is typically applicable wherever hazardous materials are stored or used, regardless of quantity.

Section 415.4 Automatic Sprinkler System

- An automatic sprinkler system is required in buildings or portions of buildings classified as Group H occupancies in accordance with Section 903.2.5.
- In other than Group H-5 occupancies, the sprinkler system required by this section is only required in those areas that have the Group H classification.

Section 415.6 Fire Separation Distance

- Building setbacks are greater for most buildings containing Group H occupancies.
- In order to provide adequate access for fire-fighting operations and venting of the products of combustion, Group H-2 and H-3 occupancies within a building must be located along an exterior wall (minimum 25% of the occupancy perimeter).
  - Exceptions for rooms of limited size and spray paint booths.

Section 415.6.1 Group H-1

- Unless a greater distance is required by the IFC, a minimum setback of 75 feet is required between the walls enclosing a Group H-1 occupancy and all lot lines.
- An exception recognizes that fireworks manufacturing buildings present unique hazards due to the potential volume (net weight) of fireworks in any single building.
- NFPA 1124 specifies the minimum separation distances between fireworks manufacturing buildings, other buildings and public highways.

Section 415.6.1.2 Group H-2

- Unless required to be in a detached building as regulated by Section 415.6.2, all Group H-2 occupancies that exceed 1000 square feet in floor area are to have at least 30 feet between the walls enclosing the Group H-2 occupancy and the lot lines surrounding the site.

Section 415.6.1.3 Groups H-2 and H-3

- Where Table 415.6.2 requires a detached building due to the quantity of hazardous materials involved, the Group H-2 and H-3 occupancies must be set back at least 50 feet from surrounding lot lines.

[F] TABLE 415.5.2
DETACHED BUILDING REQUIRED

A DETACHED BUILDING IS REQUIRED WHEN THE QUANTITY OF MATERIAL EXCEEDS THAT LISTED HEREIN			
Material	**Class**	**Solids and Liquids (tons)[a, b]**	**Gases (cubic feet)[a, b]**
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4[c] Division 1.5 Division 1.6	Maximum Allowable Quantity Maximum Allowable Quantity Maximum Allowable Quantity Maximum Allowable Quantity 1 Maximum Allowable Quantity Maximum Allowable Quantity	Not Applicable
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3 Class 2	1,200 2,000	Not Applicable Not Applicable
Organic peroxides	Detonable Class I Class II Class III	Maximum Allowable Quantity Maximum Allowable Quantity 25 50	Not Applicable Not Applicable Not Applicable Not Applicable
Unstable (reactives) nondetonable	Class 3 Class 2	1 25	2,000 10,000
Water reactives	Class 3 Class 2	1 25	Not Applicable Not Applicable
Pyrophoric gases	Not Applicable	Not Applicable	2,000

For SI: 1 ton = 906 kg, 1 cubic foot = 0.02832 m^3, 1 pound = 0.454 kg.

a. For materials that are detonable, the distance to other buildings or lot lines shall be in accordance with Chapter 33 of the *International Fire Code* based on trinitrotoluene (TNT) equivalence of the material. For materials classified as explosives, see Chapter 56 of the *International Fire Code*.

b. "Maximum Allowable Quantity" means the maximum allowable quantity per control area set forth in Table 307.1(1).

c. Limited to Division 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives (BATF) regulations or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles, provided the net explosive weight of individual articles does not exceed 1 pound.

Section 415.11 Group H-5

- Requirements for Group H-5 facilities that utilize HPM, Hazardous Production Materials.
- Is intended to be a design option for buildings that utilize hazardous materials in excess of the maximum allowable quantities permitted by Tables 307.1(1) and 307.1(2).
  - HPM facilities are considered unique high-hazard occupancies.
  - The HPM occupancy classification assumes that while the manufacturing process involves the use of hazardous materials, the end product by itself is not hazardous.

Section 416 Application of Flammable Finishes

- Addresses hazards associated with the indoor application of paints and other finishes containing flammable liquids or powders and the resulting vapors and mists.
  - Outdoor applications are not addressed.
- Safety features include: ventilation, automatic sprinklers, control of ignition sources and proper operation of the equipment.
- Provisions of the International Mechanical Code (IMC) and the International Fire Code (IFC) also apply.

416.2 Spray Rooms

- A spray room is a power-ventilated, fully enclosed room used exclusively for open spraying of flammable and combustible materials.
  - The entire spray room is considered the spray area.
  - The primary difference between a spray room and a spray booth is that spray booths are partially open to room in which they are located.

416.2 Spray Rooms

- **Requirements:**
  - A spray room is to be enclosed with fire barriers and horizontal assemblies having a fire-resistance rating of at least 1 hour.
  - Waterproof floors are to be arranged to drain either to the outside of the building, to internal drains or to other suitable places.
  - Properly designed and guarded drains or scuppers of sufficient number and size to dispose of all surplus water likely to be discharged by automatic sprinklers must be provided.

416.2.1 Spray Room Requirements

416.2.1 Construction.

Walls and ceilings of spray rooms shall be:

- Constructed of noncombustible materials or
- Interior surface shall be completely covered with noncombustible materials.
- Aluminum shall not be used.

416.2.2 Spray Room Requirements

- **Surfaces:**
  - Rough, corrugated or uneven surfaces are difficult to clean.
  - Periodic cleaning of interior surfaces reduces the fire hazard posed by the accumulation of coating overspray.
  - Due to the physical properties of aluminum, it is unsuitable and not permitted as a surface in a spray room.

416.2.3 Spray Room Requirements

- **Ventilation:**
  - The provisions addressing ventilation in spray rooms where flammable finishes are applied are found in the IMC.
  - For effective ventilation, the system must run continuously during the spraying operation phase and the drying phase of the process when vapors or dust are generated.
  - The required interlock between the ventilation and spraying equipment reduces the likelihood that the operator will fail to activate the ventilation system prior to use of the spray equipment.

416.3 Spraying Spaces

- The interior surfaces of spraying spaces shall be smooth;
  - Permit the free passage of exhaust air from the interior and to facilitate washing and cleaning;
  - Confine residues the spraying space.
  - Use of Aluminum is prohibited
- A spray space is an area within a larger room or interior space.
  - The spray area is required to be ventilated in accordance with the provisions of the IMC.
  - When the spray process is not physically separated from the other operations or areas, a noncombustible spray curtain must be provided to restrict the spread of flammable vapors.

Section 416.4 Spray Booths

- Detailed requirements for the design and construction of spray booths are given in the IFC.
- The IFC also addresses requirements for:
  - ventilation of adjacent areas,
  - fire protection,
  - fire extinguishers,
  - control of ignition sources,
  - housekeeping during operations,
  - lighting and
  - operation control through interlocks.

Section 416.5 Fire Protection

- Spray application operations are to be protected with an automatic sprinkler system or fire-extinguishing system.
- If the entire building is not protected with an automatic sprinkler system, then the system protecting the spray booth or room may be designed as a limited area sprinkler system in accordance with IBC Section 903.3.5.1.1.

Thank you!!!

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