

Objectives 

- Upon completion, participants will be better able to:
 - Apply the special provisions applicable to special building features, such as atriums, stages and platforms, and storm shelters.

Course Overview 

- Module 1 – Overview, Scope and Application of IBC Chapter 4**
- Module 2 – Special Types of Buildings**
 - High-rise Buildings
 - Underground Buildings
 - Motor-Vehicle-Related Occupancies
 - Aircraft-Related Occupancies
 - Open and Covered Mall Buildings
 - Special Amusement Buildings
- Module 3 – Special Building Features**
 - Atriums
 - Stages and Platforms
 - Storm Shelters

 **Overview, Scope and Application of IBC Chapter 4**
Module 1 

Overview 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.
- As the provisions of Chapter 4 are specific in nature, they will take precedence over any general provisions.

Subjects Addressed in Chapter 4 

- The provisions of Chapter 4 can be organized into several basic categories:
 - Special types of buildings
 - Special building features
 - High-hazard areas and operations
 - Facilities where people sleep
- Not all subject areas of Chapter 4 will be addressed in this program



Special Types of Buildings

Module 2



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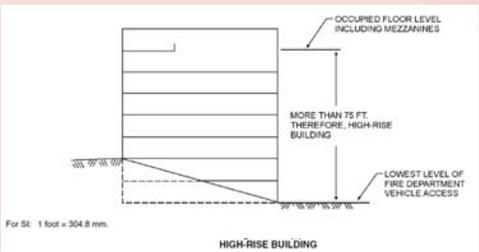
High-Rise Buildings

Section 403

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Definition of High-rise Building Section 202

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OCCUPIED FLOOR LEVEL INCLUDING MEZZANINES

MORE THAN 75 FT. THEREFORE, HIGH-RISE BUILDING

LOWEST LEVEL OF FIRE DEPARTMENT VEHICLE ACCESS

For SI: 1 foot = 304.8 mm.

HIGH-RISE BUILDING

Applicability Section 403.1

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- 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

Fire-resistance Ratings
Section 403.2.1



- 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.
- The reductions are selectively applied to various building elements as addressed in Table 601.

Fire-resistance Ratings
Section 403.2.1.1



- 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.
- In other than Group F-1, H-2, H-3, H-4, M and S-1 occupancies, the building elements in Type IB construction are permitted to be reduced to those required for Type IIA buildings.

Fire-resistance Ratings
Section 403.2.1.2



- 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.

Structural Integrity of Enclosures
Section 403.2.3



- 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.

Sprayed Fire-resistant Materials
Section 403.2.4



- 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

Automatic Sprinkler System
Section 403.3



- A key component of high-rise buildings is the required sprinkler system.
- The provisions of Section 403.3 address:
 - Number of sprinkler risers
 - System design
 - Riser location
 - Water supply to fire pumps
 - Secondary water supply

Required Emergency Systems
Section 403.4



- 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

Required Emergency Systems
Section 403.4 (cont.)



- 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

Smoke Removal
Section 403.4.7



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



Remoteness of Stairways
Section 403.5.1



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

Remoteness of Stairways
Section 403.5.1

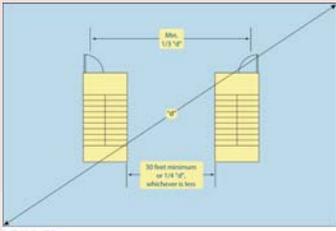



FIG. 5.1 (a) 1/4 = 25.4 mm

Additional Interior Exit Stairway
Section 403.5.2



- 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 and their ancillary spaces
 - Buildings having elevators used for occupant self-evacuation
 - Portions of building with highest floor less than 420 feet in height
- 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.

Additional Exit Stairway
Section 403.5.2

Given: High-rise > 420 feet in height (other than Group R-2)
 52.5 inches per stairway
 Total required width of 105 inches

Solution (assuming equally sized stairways):
 Minimum required stairway width of 52.5 inches per stairway.

Additional stairway per Section 403.5.2

Remainder of stair enclosures to comply with Section 403.5.1

ADDITIONAL EXIT STAIRWAY

Stairway Door Operation
Section 403.5.3

- Other than the exit discharge doors, stairway doors can be locked on the stairway side provided they are capable of being unlocked simultaneously without unlatching upon a signal from the fire command center.
- A telephone or other two-way communications system connected to an approved constantly attended station shall be provided, at minimum, at every fifth floor.

Smokeproof Enclosures
Section 403.5.4

- 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.

Luminous Egress Markings
Section 403.5.5



- 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.
- The markings shall be provided in interior exit stairway and exit passageways.
- Detailed provisions provided in Section 1025.

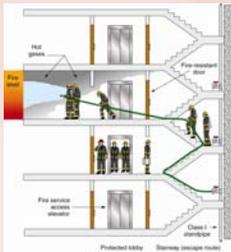
Luminous Egress Markings
Section 403.5.5




Fire Service Access Elevators
Section 403.6.1



- 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.

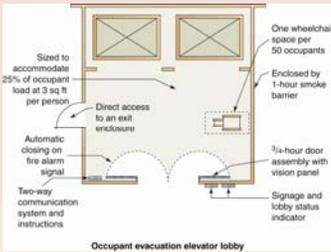


Occupant Evacuation Elevators
Section 403.6.2



- Passenger elevators installed per Section 3008 permitted to be used for occupant self-evacuation.
- Minimum required number of such elevators based on egress analysis addressing:
 - Full-building evacuation in less than 1 hour, or
 - Evacuation of 5 consecutive floors with the highest accumulation occupant load in less than 15 minutes
- Where occupant evacuation elevators are provided, the additional stairway is not required.

Occupant Evacuation Elevators
Section 403.6.2

Occupant evacuation elevator lobby



Underground Buildings

Section 405



Section 405.1
General



- 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
General

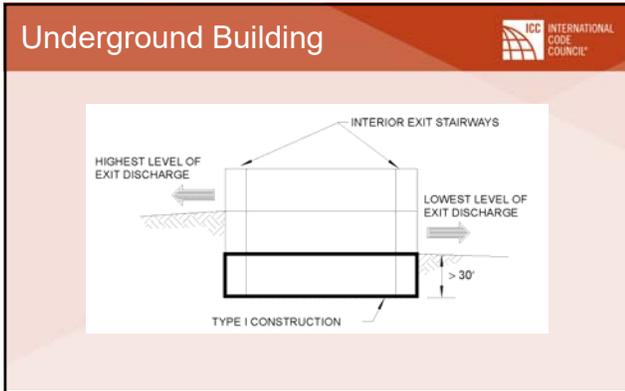


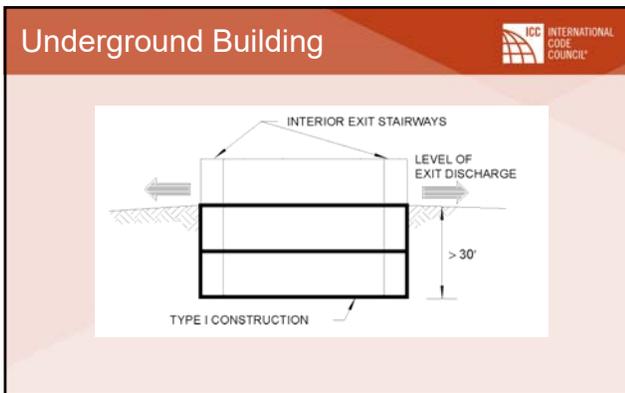
- Underground buildings present unique hazards to life safety.
 - To egress the structure, occupants must travel in an upward direction.
 - The direction of occupant travel is the same as the direction that the products of combustion travel.
 - As such, both the occupants and rescue personnel are potentially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

Section 405.1
General



- 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.





- Exemptions**
Section 405.1
- 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

Construction Requirements
Section 405.2



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

Automatic Sprinkler System
Section 405.3



- A sprinkler system is required at the highest level of exit discharge serving the underground portions of the building and all levels below.

Compartmentation
Section 405.4



- 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.

Compartmentation
Section 405.4

Compartments to be approximately equal in size

Smokeproof enclosure

20-minute fire door assemblies with smoke protection per Section 716

Min 1-hour smoke barrier wall per Section 709

1-hour-rated elevator lobby may serve one elevator

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

Elevators and Smoke Control
Sections 405.4.3 and 405.5.2

- Where a single elevator is provided to serve all compartments, an elevator lobby with direct access to each smoke compartment is required.
- Where compartmentation is required because of building depth, the required smoke control system in Section 405.5 is to be an independent system within each compartment.

Smoke Control System
Section 405.5

- 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.
-

Smoke Control System
Section 405.5



- 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.

Fire Alarm Systems
Section 405.6



- A manual fire alarm system is required in underground buildings.
- The fire alarm system shall include emergency voice/alarm communication (EVAC) when the lowest floor level is more than 60 feet below the exit discharge.

Means of Egress
Section 405.7



- A minimum of two exits are required for each level.
- All stairways must be smokeproof enclosures in accordance with Sections 1023.11 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.

Standby Power
Section 405.8.1



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

Emergency Power
Section 405.9



- Full emergency power is required for the following building systems:
 - emergency voice/alarm communication
 - fire alarm
 - automatic fire detection
 - elevator car lighting
 - means of egress illumination
 - exit sign illumination
 - fire pumps



Motor-Vehicle-Related Occupancies

Section 406



Format of Various Uses
Section 406.1



- All motor-vehicle related uses Section 406.2
- Private garages and carports Section 406.3
- Public garages, both open and enclosed Section 406.4
- Open parking garages Section 406.5
- Enclosed parking garages Section 406.6
- Motor fuel-dispensing facilities Section 406.7
- Repair garages Section 406.8

All Motor-Vehicle-Related Uses
Section 406.2



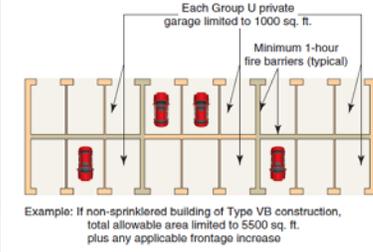
- Clear height in vehicle and pedestrian traffic areas to be no less than 7 feet.
- Openings between such uses and a room used for sleeping purposes are prohibited.
- Mixed occupancies and uses permitted in accordance with Section 508.
- Equipment and appliances having an ignition source to be elevated to point where ignition source is at least 18 inches above floor surface where appliance or equipment rests.

Private Garages and Carports
Section 406.3



- 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 two sides.

Private Garages and Carports
Section 406.3



Each Group U private garage limited to 1000 sq. ft.

Minimum 1-hour fire barriers (typical)

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

Public Parking Garages
Section 406.4

- 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.

Public Parking Garages
Section 406.4

- 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.

Public Parking Garages
Section 406.4



- Vehicle ramps intended for parking and pedestrian use cannot exceed a 1:15 slope.
- Steeper vehicle ramps cannot be part of pedestrian routes.
- Sloped pedestrian routes intended for egress between garage levels must comply with normal ramp requirements with respect to slope, landings, guards, handrails, etc., and not be shared with vehicles.

Definition of Open Parking Garage
Section 202

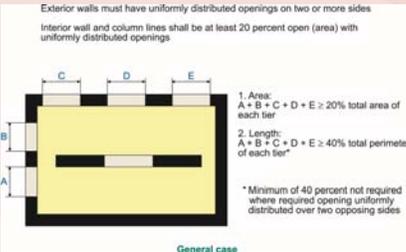


- **OPEN PARKING GARAGE.**
 - A structure or portion of a structure with the openings as described in Section 406.5.2 on two or more sides that is used for the parking or storage of private motor vehicles.

Open Parking Garage Openings
Section 406.5.2



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:
 $A + B + C + D + E \geq 20\%$ total area of each tier

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

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

General case

Open Parking Garages
Section 406.5



- Open parking garages must be of Type I, II or IV construction.
- Garages are to be used to store only private motor vehicles. All garages allowing trucks or buses must be classified as enclosed parking garages, open or not.
- Vehicle repair and dispensing of fuel is not permitted. A limited amount of garage support spaces can be in the structure.

Open Parking Garages
Section 406.5



- The required fire separation provides sufficient space next to the garage for free ventilation and reduced fire spread potential to adjacent structures.
 - Unprotected exterior openings are permitted where the fire separation distance is at least 10 feet.
- The means of egress is based on one person per 200 square feet of gross floor area.
- Enclosure is not required for exit stairways and elevator lobbies.

Open Parking Garages
Section 406.5.11



- The following uses and alterations are prohibited:
 - Vehicle repair.
 - Parking of buses, trucks, commercial vehicles.
 - Temporary or permanent enclosing of required perimeter openness.
 - Dispensing of fuel.

Open Parking Garages
Section 406.5.4



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

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
IIIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

FIG. 51. 1 square foot = 0.0929 m².

Enclosed Parking Garages
Section 406.6



- 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 system and exhaust system required in all enclosed parking garages.
- An automatic sprinkler system required in enclosed parking garages where:
 - the fire area exceeds 12,000 square feet, or
 - the garage is located beneath other occupancies.



Aircraft-Related Occupancies

Section 412



Aircraft-Related Occupancies
Section 412



- 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.

Aircraft Hangars
Section 412.3



- Aircraft hangars, classified as Group S-1 occupancies, are uniquely regulated for:
 - Exterior walls.
 - Basements.
 - Floor surface.
 - Heating equipment.
 - Finishing.
 - Fire suppression.

Aircraft Hangar Exterior Walls
Section 412.3.1



- Exterior walls shall have a minimum 2-hour fire-resistance rating where located less than 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

Aircraft Hangar Exterior Walls
Section 412.3.1

The diagram shows a cross-section of an aircraft hangar. On the left, a vertical dashed line represents the 'Public way or lot line'. A horizontal dimension line indicates a distance of '< 30 ft' between this line and the exterior wall of the hangar. An arrow points to the exterior wall with the text 'Minimum 2-hour fire-resistance rating'. The hangar interior contains an airplane, a 'Storage' area, a 'Maintenance shop', and 'Offices'. The ICC International Code Council logo is in the top right corner.

Aircraft Hangar Basements
Section 412.3.2

- Where hangars have basements, floors over basements shall be of Type IA construction and made tight against the seepage of water, oil and vapors.
- There shall be no openings or other communications between the basement and the hangar, with access only provided from the outside.

The ICC International Code Council logo is in the top right corner.

Aircraft Hangar Floor Surface
Section 412.3.3

- Hangar floors shall be sloped to drain in a manner to prevent water or fuel from remaining on the floor.
 - Not required in residential hangars where servicing, repair or washing is not conducted and fuel is not dispensed
- Floor drains shall discharge through an oil separator to the sewer or an outside vented sump.

The ICC International Code Council logo is in the top right corner.

Aircraft Hangar Heating Equipment Section 412.3.4 

- Heating equipment shall be in another room separated by minimum 2-hour fire barriers and/or horizontal assemblies.
 - Exception for unit heaters and infrared heating equipment suspended at a minimum specified height
- Entrance shall be from:
 - the outside, or
 - through a vestibule providing a two-doorway separation
 - Exception allows single door where appliance sources of ignition are located at least 18 inches above the floor

Aircraft Hangar Finishing Section 412.3.5 

- The process of “doping,” involving the use of a volatile flammable solvent, or of painting, shall occur in a separate detached building.
 - Section 412.6 regulates aircraft paint hangars, with the following special conditions:
 - Classified as Group H-2
 - Type I or II construction
 - Limits on quantities of flammable liquids necessary for painting
 - Fire suppression per NFPA 409
 - Ventilated per IMC

Aircraft Hangar Fire Suppression Section 412.3.6 

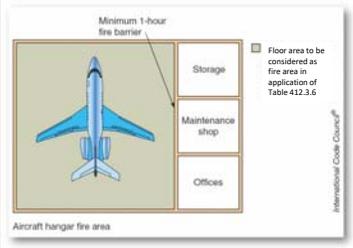
- Aircraft hangars shall be provided with a fire suppression system in accordance with NFPA 409, based on the classification for the hangar as given in Table 412.3.6.
- The classification as Group I, II or III is based on the fire area size and the building’s type of construction.

Aircraft Hangar Fire Areas
Section 412.3.6.2



- Maximum fire area size as applied to Table 412.3.6 is established through the use of minimum 2-hour fire walls.
- Ancillary uses separated from the hangar by minimum 1-hour fire barriers need not be included in the determination of fire area size.

Aircraft Hangar Fire Areas
Section 412.3.6.2



Aircraft hangar fire area



Open and Covered Mall Buildings

Section 402



Covered and Open Mall Buildings
Section 402



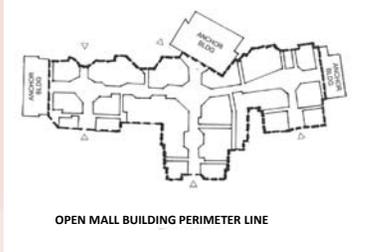
- The special provisions applicable to covered mall buildings and open mall buildings are only applicable to those buildings no more than:
 - 3 floor levels at any point, and
 - 3 stories above grade plane.
- Buildings need not comply with Section 402 if they totally comply with other applicable provisions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

Perimeter Line
Section 402.1.1



- 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.

Perimeter Line
Section 402.1.1



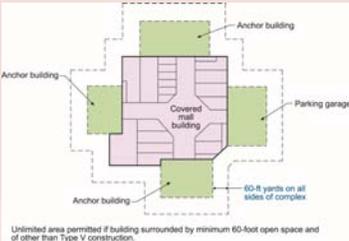
OPEN MALL BUILDING PERIMETER LINE

Open Space
Section 402.1.2



- 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.

Open Space
Section 402.1.2

Definitions
Section 202



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

Definitions
Section 202



- **COVERED MALL BUILDING.**
 - A single building enclosing a number of tenants and occupants:
 - such as retail stores, drinking and dining establishments, entertainment and amusement facilities, passenger transportation terminals, offices and other similar uses wherein two or more tenants have a main entrance into one or more malls.
 - Anchor buildings shall not be considered as a part of the covered mall building. The term “covered mall building” shall include open mall buildings defined as follows:

Definitions
Section 202



- **MALL.**
 - A roofed or covered common pedestrian area within a covered mall building that serves as access for two or more tenants and not to exceed three levels that are open to each other.
 - The term “mall” shall include open malls defined as follows:

Definitions
Section 202



- **OPEN MALL.**
 - An unroofed common pedestrian way serving a number of tenants not exceeding three levels.
 - Circulation at levels above grade shall be permitted to include open exterior balconies leading to exits discharging at grade.

Definitions
Section 202



- **OPEN MALL BUILDING.**
 - Several structures housing a number of tenants
 - Structures such as retail stores, drinking and dining establishments, entertainment and amusement facilities, offices, and other similar uses, wherein two or more tenants have a main entrance into one or more open malls.
 - Anchor buildings are not considered as a part of the open mall building.

Definitions
Section 202



- **FOOD COURT.**
 - A public seating area located in the mall that serves adjacent food preparation tenant spaces.

Definitions
Section 202



- **GROSS LEASABLE AREA.**
 - The total floor area designed for tenant occupancy and exclusive use.
 - The area of tenant occupancy is measured from the centerlines of joint partitions to the outside of the tenant walls.
 - All tenant areas, including areas used for storage, shall be included in calculating gross leasable area.

Gross Leasable Area Definition
Section 202

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Lease Plan
Section 402.3

- Building and fire departments require the filing of up-to-date lease plans for open mall and covered mall buildings.
- These lease plans are typically submitted after the mall certificate of occupancy has been issued since initial tenant lease lines are rarely known at the time of mall construction.

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Area and Types of Construction
Section 402.4.1.1

- Covered mall and open mall 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
 - Buildings are:
 - 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

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Area and Types of Construction
Section 402.4.1.2



- Anchor buildings regulated for building area and building height based on type of construction as required by general provisions of Chapter 5, except:
 - Building area not limited where anchor building is:
 - of Type I, II, III or IV construction
 - not more than three stories above grade

Parking Garages
Section 402.4.1.3



- Attached and detached parking garages are regulated by IBC Section 406 for allowable height and area.
- Parking garages are not regulated by the mall building's type of construction and are not provided with an unlimited area allowance.

Fire Separations
Section 402.4.2



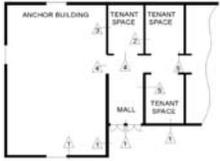
- Historical experience on automatic sprinkler performance indicates separation between individual tenant spaces and the mall area is not warranted.
- In order to limit the spread of smoke, tenant separation walls are required to be fire partitions with a fire-resistance rating of at least 1 hour and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

Fire Separations
Section 402.4.2



- 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.

Fire Separations
Section 402.4.2

- WALL CONSTRUCTED AS REQUIRED FOR AN EXTERIOR WALL
- WALL CONSTRUCTED AS REQUIRED FOR A TENANT SEPARATION BY SECTION 402.4.3.1
- WALL CONSTRUCTED AS REQUIRED BY SECTION 402.4.2.2 (FIRE WALL OR FIRE BARRIER)
- UNPROTECTED OPENING
- WALL CONSTRUCTED AS REQUIRED BY SECTION 402.4.2

Figure 402.4
TENANT SPACE AND ANCHOR BUILDING SEPARATIONS

Parking Garages
Section 402.4.2.3



- Buildings adjacent to covered mall buildings are typically considered separate buildings provided they are separated by exterior walls or fire walls.
- Due to the limited hazard presented by attached garages and open parking garages, such structures can be considered as separate buildings where fire barriers and horizontal assemblies having a fire-resistance rating of at least 2 hours are provided.

Open Mall Construction
Section 402.4.3



- 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.

Automatic Sprinkler System
Section 402.5



- Both covered and open mall buildings and any connected buildings, other than open parking garages, must be protected with an automatic sprinkler system.
- The system must be:
 - Designed, installed, tested and maintained in accordance with Chapter 9, the International Fire Code (IFC) and NFPA 13.
 - Installed such that any portion serving tenant spaces in a covered mall building may be shut down independently so that changes can be made to it during tenant modifications.
- Exterior areas in open malls below overhead walkways must be provided with sprinklers.

Kiosks
Section 402.6.2



- 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.

Emergency Systems
Section 402.7



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

Standpipe Systems
Section 402.7.1



- A Class I wet standpipe system with hose connections shall be provided at:
 - exterior public entrances to the mall of covered mall building.
 - public entrances at perimeter line of open mall building
 - within mall at entrance to each exit passageway or corridor.
 - each floor-level landing within interior exit stairways opening directly on the mall.
 - other locations such that all portions of a tenant space within 200 feet of a hose connection.

Smoke Control System
Section 402.7.2



- In order to minimize smoke spread and ensure that the mall remains tenable for use as an exit access, a smoke control system is required in three-story covered mall buildings.
- The smoke control system also is required in anchor buildings where an atrium connects three or more stories.

Emergency Power
Section 402.7.3



- Covered and open mall buildings exceeding 50,000 square feet in area are required to have a standby power system for the emergency voice/alarm communication system.
 - For open mall buildings, the threshold of 50,000 square feet is based on the floor area within the building's perimeter line as described in Section 402.1.2.

EV/AC System
Section 402.7.4



- An emergency voice/alarm communication system (EV/AC) provides fire department communication and control during an emergency situation.
- An EV/AC is required for covered and open mall buildings more than 50,000 square feet in floor area.

FD Access to Equipment
Section 402.7.5



- The fire department must have access to controls for the air-conditioning and fire protection systems.
- The controls are to be clearly identified so that fire department personnel can quickly locate and operate them.

Means of Egress
Section 402.8



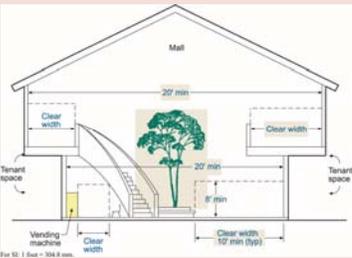
- Most of the special mall building means of egress requirements are based on the assumption that the use of a mall building will be primarily mercantile and business, with some assembly.
- The specific egress requirements in Section 402.8 supersede some of the more general provisions of Chapter 10.

Mall Width
Section 402.8.1



- 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.

Mall Width
Section 402.8.1



For 10' > 104.8 min.

Occupant Load Determination
Section 402.8.2



- 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.

Occupant Load Factor
Section 402.8.2.1



- If the gross leasable area (GLA) of the covered or open mall building is 400,000 square feet, the calculated Occupant Load Factor is determined using Equation 4.1 as follows:
- Occupant Load Factor = $(0.00007)(GLA) + 25$
- OLF = $(0.00007)(400,000) + 25 = 53$ sf/person

Occupant Load Factor
Section 402.8.2.2



- Since the design occupant load factor is limited to 50 by Section 402.8.2.2, an Occupant Load Factor of 50 square feet per person is to be applied.
- Where the calculated occupant load factor is less than 30, a factor of 30 is to be applied.

Anchor Buildings
Section 402.8.2.3



- 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.

Food Courts
Section 402.8.2.4



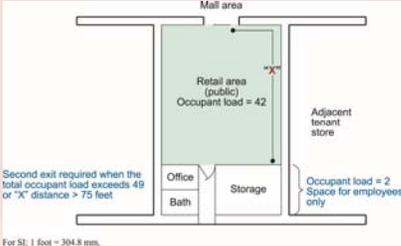
- The occupant load for food courts must be determined in accordance with Section 1004 (15 square feet) per person at table and chair seating.
 - The occupant loads for all food courts are to be added to the mall occupant load calculated in accordance with Section 402.8.2.1 and Equation 4-1.
 - Food courts are not considered part of the gross leasable area of the mall; therefore, the occupant loads of the food courts must be calculated separately and then added to the overall covered or open mall building occupant load.

Number of Means of Egress
Section 402.8.3



- This section applies within each tenant space.
- Within a single means of egress tenant space, the travel distance to the mall for occupants other than employees shall be limited to 75 feet.
- In addition, a single means of egress tenant space must have an occupant load of 49 or less.

Number of Means of Egress
Section 402.8.3



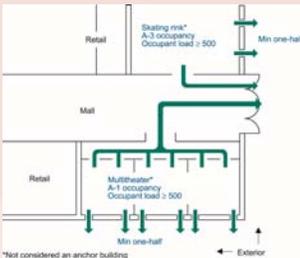
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Assembly Means of Egress
Section 402.8.4

- Assembly occupancies (movie theaters, nightclubs and large restaurants) with an occupant load of 500 or more must be located on an exterior wall of a covered mall building and adjacent to the mall's exits.
- A maximum of 50 percent of the means of egress from these assembly occupancies is permitted to discharge into the mall.

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Assembly Means of Egress
Section 402.8.4



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Anchor Building Means of Egress
Section 402.8.4.1



- 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.

Distance to Exits
Section 402.8.5



- 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 a covered mall building to an exit, as well as from any point within an open mall building to the perimeter line.

Distance to Exits
Section 402.8.5

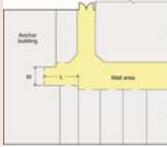


Note: Travel distance is to be measured along the natural and unobstructed path of egress travel.

Access to Exits
Section 402.8.6



- Corridors and exit passageways from a mall must be at least 66 inches wide.
- The maximum dead end permitted in a mall is twice the width of the mall.



Exit Passageway Service Areas
Section 402.8.7



- Openings from normally occupied spaces may not open into exit passageways.
- In the case of mall buildings, utility spaces and mechanical rooms are permitted to open into exit passageways provided that the fire-resistance rating of the exit passageway is maintained by appropriate opening protection, such as fire doors, fire dampers and through-penetration firestop systems.

Security Grilles and Doors
Section 402.8.8



- 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.

Special Amusement Buildings

Section 411

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Definition
Section 202

- 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.

Special Amusement Buildings
Section 411

- 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-3.
- All flammable decorative materials used in special amusement buildings are required to follow the provisions of the IFC.

Special Amusement Buildings
Section 411



- 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, ensuring that egress is readily apparent and not intentionally confusing.

Automatic Fire Detection
Section 411.2



- 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.

Automatic Sprinkler System
Section 411.3



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

Alarm
Section 411.4



- 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.

Emergency Voice/Alarm System
Section 411.5



- An emergency voice/alarm communication system (EV/AC) must be provided.
 - The EV/AC 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.

Exit Marking
Section 411.6



- 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.

Exit Marking
Section 411.6



- The automatic fire detection system and/or automatic sprinkler system must activate all dimmed or darkened exit markings.

Interior Finish
Section 411.8



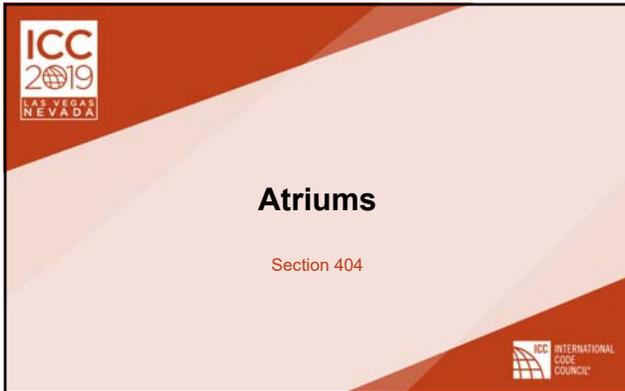
- Due to the potential for fire to spread quickly in the relatively confined spaces in these structures, only Class A materials are permitted to be used as interior finishes.
- Special amusement buildings are not permitted finish classification reductions normally allowed by Table 803.13 for sprinklered buildings.

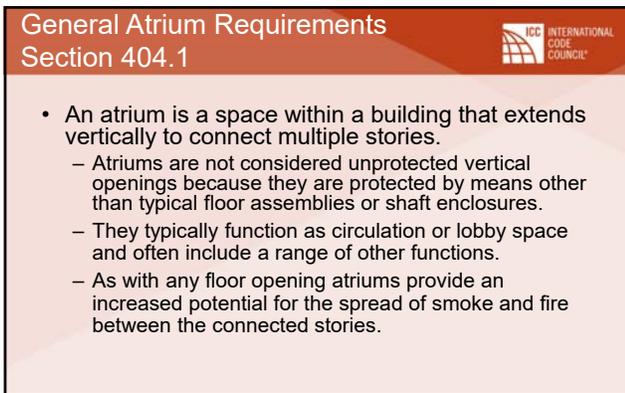


Special Building Features

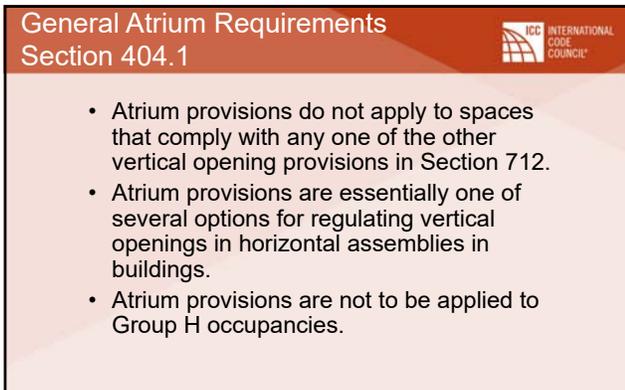
Module 3







- An atrium is a space within a building that extends vertically to connect multiple stories.
 - Atriums are not considered unprotected vertical openings because they are protected by means other than typical floor assemblies or shaft enclosures.
 - 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.



- Atrium provisions do not apply to spaces that comply with any one of the other vertical opening provisions in Section 712.
- Atrium provisions are essentially one of several options for regulating vertical openings in horizontal assemblies in buildings.
- Atrium provisions are not to be applied to Group H occupancies.

Definition
Section 202



- **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.



Atrium Use
Section 404.2



- The activities at the floor level and the types of materials in the atrium space must be controlled regardless of their height or area.
- Low fire-hazard uses would limit the atrium floor to such functions as pedestrian walk-through areas, security desks, reception areas, etc.
- When the atrium floor area is equipped with an automatic sprinkler system that can provide the required protection, then its use is not restricted.

Automatic Sprinkler Protection
Section 404.3



- All floor areas connected to the atrium are to be protected with an automatic sprinkler system, including the atrium space itself.
- When the atrium space is separated from the remainder of the building by 2-hour fire barriers or horizontal assemblies, only the atrium space is required to be sprinklered (except as required by other code sections).
- Sprinklers are not required at the atrium ceiling when the ceiling is greater than 55 feet above the atrium floor.

Fire Alarm System
Section 404.4



- Section 907.2.13 requires a fire alarm system in atriums connecting more than two stories.
- When atriums are located in Groups A, E and M occupancies, an emergency voice/alarm communication system is also required.

Smoke Control
Section 404.5



- A mechanical smoke control system is required in all atriums connecting 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.

Enclosure of Atriums
Section 404.6



- Although a fire-resistance-rated separation is typically required as the atrium enclosure, a glass wall that forms a smoke partition can be substituted.
 - Sprinklers are to be provided on both sides of the glass wall, but permitted on only the room side where no walkway occurs on the atrium side.
- Up to three floors can be open to the atrium without any form of separation if accounted for in the design of the smoke control system.

Enclosure of Atriums
Section 404.6



- 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 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.

Standby Power
Section 404.7



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

Interior Finish
Section 404.8



- 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.

Travel Distance
Section 404.9



- The total exit access travel distance through the upper levels of an atrium is limited to 200 feet.
- Since smoke is being drawn to the atrium via smoke control, the time allowed to reach an exit through the upper levels needs to be limited.
- Exit access travel distance at the atrium floor level and at levels that do not communicate with the atrium is regulated by the normal provisions in Table 1017.2.

Interior Exit Stairways
Section 404.10



- It is acceptable for up to 50 percent of interior exit stairways to egress through an atrium at the level of exit discharge in accordance with Section 1028.



Stages and Platforms

Section 410



Stages and Platforms
Section 410



- 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.

Stages and Platforms
Section 410



- 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.

Definitions
Section 202



- **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.

Definitions
Section 202



- **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.

Definitions
Section 202



- **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.

Stage Construction
Section 410.2.1



- Stages shall be constructed of materials as required for floors based on the building's type of construction.
 - Exception 1 allows buildings of any construction type to be constructed with a nominal 2-inch (51 mm) wood deck supported by either unprotected noncombustible construction (Type IIB) or heavy timber construction (Type IV).
 - Exception 2 does not require stages to be fire-resistance rated in buildings of Types IIA, IIIA and VA where the space below the stage is equipped with an automatic sprinkler system or fire-extinguishing system.

Stage Floor Construction
Section 410.2.1



- In all types of construction, the finished floor shall be constructed of wood or approved noncombustible materials.
- Openings in stage floors are to be protected with tight-fitting solid wood doors with safety locks to secure them.

Stage Height and Area
Section 410.2.1.1



- All wing areas and backstage areas are included as the stage area, unless separated by fire-resistance-rated construction.
- Stage height is defined as the height from the stage floor to the stage roof or highest horizontal assembly that encloses the stage space.
- Stage height includes the fly gallery and fly loft above the stage.

Stage Proscenium Wall
Section 410.2.4



- 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.

Stage Proscenium Curtain
Section 410.2.5



- 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.

Stage Ventilation
Section 410.2.7



- 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.
- Smoke control may be used as an option to required roof vents.

Platform Construction
Section 410.3



- 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, no more than one-third of the floor area of the room, and
 - no more than 3,000 square feet in area.
- Temporary platforms (installed for 30 days maximum) 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.

Dressing and Appurtenant Rooms Section 410.4 

- 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

Stage Means of Egress Section 410.5 

- Chapter 10 egress requirements are applicable to stages, platforms and technical production areas except where modified by Section 410.5.
- When two means of egress are required due to stage size, at least one is required on each side of the stage.
- Exit access stairways, in front of or behind the proscenium wall, that serve a stage or stage areas do not require enclosure.

Technical Production Areas Section 410.5.3 

- Fly galleries, gridirons and other technical production areas need only be provided with one approved means of egress.
- Travel distance is limited to 300 feet, 400 feet where the building is sprinklered.
 - Where two or more means of egress are required, one of the means of egress may lead to the roof.
- The egress path may include spiral stairways, alternating tread devices or fixed ladders.

Automatic Sprinkler System
Section 410.6



- Areas, such as dressing rooms, workshops and storerooms, are required to be protected with an automatic sprinkler system.
 - Exception 1 applies to areas less than 4 feet in clear height under stages that are used only for the storage of tables and chairs.
 - Exception 2 applies to stages 1,000 square feet or less in area and 5 feet or less in height.
 - Exception 3 acknowledges portable orchestra enclosures which are temporary in nature and are intended to improve the acoustics of the stage performances.

Standpipes
Section 410.7



- A Class III wet standpipe system is required on each side of stages greater than 1,000 square feet in area.
- The standpipes require both a 1½-inch and a 2½-inch hose connection.



Storm Shelters

Section 423



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.



Definitions Section 202 

- 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.

Definitions Section 202 

- 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.

Scope
Section 423



- 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

Shelter Design Wind Speed Map
ICC 500




Critical Emergency Operations
Section 423.3



- Facilities regulated include:
 - 911 call stations
 - Emergency operation centers
 - Fire, rescue, ambulance and police stations
- An exception can be made for an individual space used as shelter where entire building is designed as a storm shelter.

Group E Occupancies
Section 423.4



- Provision applies to all Group E occupancies except:
 - Group E day care facilities
 - Group E occupancies accessory to places of religious worship
 - Where an entire structure is designed as a shelter.

Group E Occupancies
Section 423.4.1



- Required occupant capacity to include all buildings on site and be the greater of:
 - total occupant load of the Group E occupancy, based on Usable Floor Area as established in ICC 500, and including classrooms, vocational rooms and offices, or
 - occupant load of any indoor assembly space associated with the Group E occupancy.
- Shelters to be located in same buildings they serve, or within 1,000 from a door in facility to a door of the shelter.



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