Goal

The goal of this seminar is to provide participants with an understanding fire and life safety principles in the 2018 IBC.

Objectives

Upon completion, participants will be better able to:
1. Classify uses into occupancy groups.
2. Determine the type of construction of a proposed building.
3. Calculate actual and allowable building height and floor area.
4. Identify required fire-resistance-rated assemblies.
5. Determine interior finish requirements.
6. Identify any fire protection systems required.
7. Determine means of egress design and component requirements.
Overview

- Application of the IBC
- Occupancy Classification and Use
- Types of Construction
- Special Detailed Requirements Based on Use and Occupancy
- General Building Heights and Area
- Fire and Smoke Protection Features
- Interior Finishes
- Fire Protection and Life Safety Systems
- Means of Egress

Scope/Applicability Provisions

- 101.2 – Scope
- 101.3 – Intent
- 101.4 – Referenced codes
- 102.1 – General vs. specific application
- 102.4 – Referenced codes and standards
- 104.1 – Building official interpretive authority
- 104.8 – Liability
- 104.11 – Alternate materials, design and methods
Effective Use of the IBC

- The following procedure is suggested:
  - Building Classification
  - Fire Protection Systems
  - Means of Egress
  - Fire and Smoke Protection Features
  - Interior Finishes
  - Special Detailed Requirements Based on Use and Occupancy
  - Additional Applicable Provisions

Administration

1. When the board of appeals makes a decision inconsistent with that of the building official, whose decision is to be applied?

   Section 113.2 indicates that the board of appeals has the authority to overrule the building official's decision, but that authority is limited to three areas of appeal: 1) interpretation of a provision, 2) applicability of the provision, or 3) equivalent or better construction.

2. Does the building official have the authority to interpret the code in a way that waives the requirements specifically provided for in the IBC?

   Section 104.1 states that an interpretation must not have the effect of waiving requirements of the code.
Module 2

Chapter 3 – Occupancy Classification and Use

Occupancy Classification

- Uses are grouped by occupancy based on similar:
  - Life safety characteristics
  - Combustible content
  - Fire hazards

Occupancy Classification

To achieve equivalent safety in building design, each occupancy group and division varies by:
- Type of construction restrictions.
- Fire protection requirements.
- Location, area and height limitations.
- Means of egress elements.
Occupancy Classification

Occupant-related Hazards
- Number of occupants.
- Density of the occupants.
- Age of the occupants.
- Mobility of the occupants.
- Awareness of the occupants.

Occupancy Classification

Content-related Hazards
- Density of contents.
- Quantity of contents.
- Type of contents.
- Environment of contents.
- Flammability of contents.

Occupancy Classification

Section 302.1
- A — Assembly.
- B — Business.
- E — Educational.
- F — Factory and Industrial.
- H — Hazardous.
- I — Institutional.
- M — Mercantile.
- R — Residential.
- S — Storage.
- U — Utility and Miscellaneous.
Occupancy Classification
Sections 303-305

- 303.1 – Assembly Group A
  - Group A-1
  - Group A-2
  - Group A-3
  - Group A-4
  - Group A-5
- 304.1 – Business Group B
- 305.1 – Educational Group E

Occupancy Classification
Sections 306-307

- 306.1 – Factory Group F
  - Group F-1
  - Group F-2
- 307.1 – High-Hazard Group H
  - Group H-1
  - Group H-2
  - Group H-3
  - Group H-4
  - Group H-5

Occupancy Classification
Sections 308-309

- 308.1 - Institutional Group I
  - Group I-1 (Conditions 1 and 2)
  - Group I-2 (Conditions 1 and 2)
  - Group I-3
  - Group I-4
- 309.1 – Mercantile Group M
Occupancy Classification
Sections 310-312

- 310.1 – Residential Group R
  - Group R-1
  - Group R-2
  - Group R-3
  - Group R-4 (Conditions 1 and 2)
- 311.1 – Storage Group S
  - Group S-1
  - Group S-2
- 312.1 – Group U: Utility and Miscellaneous

1. Cell Phone Tower

2. Insurance Office
15. Kitchen Serving a Restaurant

16. Boarding House

17. Facility Used to Care for Children
What information is required to properly classify the following?

18. Dance Studio for Children

19. Private Garages for Condominiums

20. Self-storage Facility
What information is required to properly classify the following?

### 21. Dental Office

![Image of Dental Office]

### 22. Casino Gaming Area

![Image of Casino Gaming Area]

### 23. Fast Food Carry-out

![Image of Fast Food Carry-out]
What information is required to properly classify the following?

24. Assisted Living Facility

Chapter 6 – Types of Construction

Module 3

Types of Construction

- 602.1 – Construction Classification
- 602.2 – Construction Types I and II
- 602.3 – Construction Type III
- 602.4 – Construction Type IV
- 602.5 – Construction Type V
Types of Construction

<table>
<thead>
<tr>
<th>Material</th>
<th>Structural Elements</th>
<th>Construction Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncombustible</td>
<td>Exterior and interior (bearing or non-bearing) walls, floors, roofs, and structural elements to be of non-combustible materials</td>
<td>IBA, IIA, IB</td>
</tr>
<tr>
<td>Combustible and/or noncombustible</td>
<td>Exterior walls to be of non-combustible materials</td>
<td>IBA, IIB, IV, VA, VB</td>
</tr>
</tbody>
</table>

Table 601

<table>
<thead>
<tr>
<th>Element</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
<th>Type 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Section</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearing Wall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-bearing Wall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof Decking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof Support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 601 Notes

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.
d. Not less than the fire-resistance rating required by other sections of this code.
e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).
f. Not less than the fire-resistance rating as referenced in Section 704.10.
Types of Construction
Table 601, Note b

Fire protection of roof structural members, including structural frame members, framing and decking, not required

Note: Applies to all occupancies except Groves (F-1, H, M, and R).

Applicable to all permitted structural types.

Fire Protection Code (FPC) - 0.8 feet = 0.244 meters.

Type I Construction

TYPE IA

ROOF 1 1/2 HOURS

FLOOR/CEILING 2 HOURS

NONB REATING PARTITION 1 HOUR

STRUCTURAL FRAME OR INTERNAL BEARING WALL 2 HOURS

* See Notes to Tables 601 and 602

Type I Construction

TYPE IB

ROOF 1 HOUR

FLOOR/CEILING 2 HOURS

NONB REATING PARTITION 1 HOUR

STRUCTURAL FRAME OR INTERNAL BEARING WALL 2 HOURS

* See Notes to Tables 601 and 602
Section 603 – Combustible Material in Type I and Type II Construction

- Fire-retardant-treated (FRT) wood in:
  - Nonbearing partitions of 2 hours or less
  - Nonbearing exterior walls where rating not required
  - Thermal and acoustical insulation with limited flame spread.
- Foam plastics in accordance with Chapter 26.
- A, B or C roof coverings.
- Interior floor finish, trim, millwork, doors, frames, etc.
Section 603 – Combustible Material in Type I and Type II Construction

- Platforms in accordance with Section 410.
- Blocking for handrails, cabinets, fixtures, etc.
- Light-transmitting plastics in accordance with Chapter 26.
- Nailing or furring strips in accordance with Section 803.15.
- Heavy timber (HT) for specific components.
- Additional applications as specified.

Special Detailed Requirements

- 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
Special Detailed Requirements

- 409 – Motion picture projection rooms
- 410 – Stages, platforms and technical production areas
- 411 – Special amusement buildings
- 412 – Aircraft-related occupancies
- 413 – Combustible storage
- 414 – Hazardous materials

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Special Detailed Requirements

- 416 – Spray application of flammable finishes
- 417 – Drying rooms
- 418 – Organic coatings
- 419 – Live/work units
- 420 – Groups I-1, R-1, R-2, R-3 and R-4

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Special Detailed Requirements

- 421 – Hydrogen fuel gas rooms
- 422 – Ambulatory health care facilities
- 423 – Storm shelters
- 424 – Children’s play structures
- 425 – Hyperbaric facilities
- 426 – Combustible dusts, grain processing and Storage
- 427 – Medical gas systems
- 428 – Higher education laboratories
Special Detailed Requirements Based on Use and Occupancy

1. **What is the purpose of a control area?**
   Sections 414.2 and 307.1. Control areas are used by the designer to permit additional quantities of hazardous materials in buildings not classified as Group H. Up to the maximum allowable quantities of hazardous materials may be located in each control area as limited by Table 414.2.2.

2. **How must individual dwelling units be separated from other areas of an apartment building?**
   Section 420. Dwelling units must be separated from each other and from other occupancies in the building through the use of fire partitions and/or horizontal assemblies.
Allowable Area

- Essential ingredients in the determination of allowable areas include:
  - Type and amount of combustibles due to the use of the building.
  - Amount of combustibles contained in the construction of the building.
  - Features, such as automatic sprinkler systems, open yards and fire walls.

Area Limitations

- The restrictions for maximum building area are intended to limit the size of the fire that potentially may develop.

- Primary concern is that of property damage and spread of fire to adjacent buildings.

Area Limitations

- Life safety is considered because of the number of occupants.

- Fire fighting accessibility and protection of fire department personnel is a factor.
Area Limitations

- To determine allowable building area of the structure:
  - Determine the allowable area factor based on the occupancy classification, type of construction and sprinkler protection as set forth in Table 506.2.
  - Determine any allowable increase based on the buildings location on the lot (Section 506.3).

Section 503 – General Height and Area Limitations

Section 503.1.2 – Buildings on the Same Lot
### Table 504.3 – Building Height

<table>
<thead>
<tr>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
<th>Type E</th>
<th>Type F</th>
<th>Type G</th>
<th>Type H</th>
<th>Type I</th>
<th>Type J</th>
<th>Type K</th>
<th>Type L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 1</td>
<td>1 x 2</td>
<td>1 x 3</td>
<td>1 x 4</td>
<td>1 x 5</td>
<td>1 x 6</td>
<td>1 x 7</td>
<td>1 x 8</td>
<td>1 x 9</td>
<td>1 x 10</td>
<td>1 x 11</td>
<td>1 x 12</td>
</tr>
</tbody>
</table>

### Table 504.4 – Building Height in Stories Above Grade Plane

<table>
<thead>
<tr>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
<th>Type E</th>
<th>Type F</th>
<th>Type G</th>
<th>Type H</th>
<th>Type I</th>
<th>Type J</th>
<th>Type K</th>
<th>Type L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 1</td>
<td>1 x 2</td>
<td>1 x 3</td>
<td>1 x 4</td>
<td>1 x 5</td>
<td>1 x 6</td>
<td>1 x 7</td>
<td>1 x 8</td>
<td>1 x 9</td>
<td>1 x 10</td>
<td>1 x 11</td>
<td>1 x 12</td>
</tr>
</tbody>
</table>
Table 504.4 – zoom into B

<table>
<thead>
<tr>
<th>Usage Separation</th>
<th>Type of Division</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS</td>
<td>E1</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 506.2

<table>
<thead>
<tr>
<th>Allowable Area Factors (A, B, C, D, E, F, G, H, I, J)</th>
<th>Usage Separation</th>
<th>Type of Division</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS</td>
<td>E1</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
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<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Table 506.2 zoom to B

<table>
<thead>
<tr>
<th>Allowable Area Factors (A, B, C, D, E, F, G, H, I, J)</th>
<th>Usage Separation</th>
<th>Type of Division</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS</td>
<td>E1</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
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<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
Section 505 – Mezzanines

- Not considered as an additional story.
- Not included in building area.
- Included in fire area.
- Regulated for means of egress under the general provisions of Chapter 10.
- The clear height above and below the mezzanine floor must not be less than 7 feet (2134 mm).

Section 505.2.3 – Mezzanine Openness

Section 506 – Building Area

- A building’s maximum allowable floor area is determined based on a variety of factors:
  - The building’s type of construction.
  - The occupancy classification(s) housed in the building.
  - Whether or not there is a sprinkler system in the building.
  - If sprinklered, the type of sprinkler system installed (Group R.)
  - Amount of open space (frontage) at the building’s perimeter.
  - The number of stories in the building.
Table 506.2 – Allowable Area Factor

<table>
<thead>
<tr>
<th>Description</th>
<th>Capacity</th>
<th>Width</th>
<th>Length</th>
<th>Total Allowable Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-occ. one-story</td>
<td>125</td>
<td>12</td>
<td>20</td>
<td>2,500</td>
</tr>
<tr>
<td>Mixed-occ. one-story</td>
<td>125</td>
<td>12</td>
<td>20</td>
<td>2,500</td>
</tr>
<tr>
<td>Single-occ. multistory</td>
<td>125</td>
<td>12</td>
<td>20</td>
<td>2,500</td>
</tr>
<tr>
<td>Mixed-occ. multistory</td>
<td>125</td>
<td>12</td>
<td>20</td>
<td>2,500</td>
</tr>
</tbody>
</table>

Section 506.2 – Allowable Area Determination

- For all of the following conditions, Table 506.2 establishes the allowable area factor that is the basis for determining the building’s total allowable area:
  - Single-occupancy, one-story buildings.
  - Mixed-occupancy, one-story buildings.
  - Single-occupancy, multistory buildings.
  - Mixed-occupancy, multistory buildings.

Section 506.3 – Frontage Increase

The following apply to an area increase for frontage:

- It is based on the percentage of open perimeter.
- There is no increase where the perimeter is no more than 25-percent open.
- There is typically a maximum increase of 75 percent where the entire perimeter is open.
- The open space must be at least 20 feet (6096 mm) wide to be considered open, with 30 feet (9144 mm) typically required to obtain the maximum increase.
- The open spaces are to be accessed from a street or a fire lane.
Section 506.3 – Frontage Increase

- The following formula is to be used in determining the area increase due to frontage.

\[ I_f = \left[ \frac{F}{P} - 0.25 \right] \frac{W}{30} \]

Example 1 of Area Increase for Frontage

- Given: Yards as shown, 40-foot (12 192 mm) street
- Determine: Percent increase for area purpose \((I_f)\)

\[
\begin{align*}
F &= 310' \\
P &= 460' \\
W &= 35', 70', 90' \\
310 &- 0.25 \times 460 \\
(0.42) &\times 30 \\
& \approx 42
\end{align*}
\]

*Where \(W\) exceeds 30 feet (9144 mm), a value of 30 feet (9144 mm) is to be used.*
Allowable Area Calculation

- **Given:** Four-story office building, Type IIB construction
- Fully sprinklered, Yards and streets as shown

Allowable Area Activity

Determine: Maximum allowable area for the building ($A_A$)

$$A_A = (A + (N - 1)S^2) - 3$$

**Example:**

- $A = 69,000$ square feet (6420 m²) (Table 506.2)
- $N = 33,000$ square feet (3117 m²)
- $I = \frac{1200}{220} = 0.55 (0.55) = 0.25$ (from Table 506.2)
- $S = 3$

- $A_A = 69,000 - \left[23,000(0.42)\right] - 3$
- $= 69,000 - 9,660 = 3$
- $= 79,660$ square feet (7408 m²) per story $\times 3$
- $= 239,980$ square feet (22,033 m²) for building

Section 507 – Unlimited Area Buildings

- The allowance of unlimited area permitted by Section 507 are commonly applied to the following buildings:
  - One-story nonsprinklered Group F-2 or S-2, surrounded by a minimum of 60-foot (18 288 mm) open space.
  - One-story sprinklered Groups A-4 (other than Type V construction), B, F, M or S surrounded by a minimum 60-foot (18 288 mm) open space (sprinklers may be omitted from participant areas of Group A-4 under specific conditions).
  - Two-story sprinklered Group B, F, M or S occupancies surrounded by a minimum 60-foot (18 288 mm) open space.
Section 508 – Mixed Occupancies

- The designer must select one of the following methods to address each occupancy pairing that occurs:
  - Accessory occupancies.
  - Nonseparated occupancies.
  - Separated occupancies.

Section 508.2 – Accessory Occupancies

- Compliance as accessory occupancy and separation of occupancies by fire barriers are not required where four conditions exist:
  - Occupancy under consideration is accessory to major occupancy.
  - Occupancy is not a Group H occupancy.
  - Occupancy does not exceed 10 percent of the area of the story where it is located.
  - Occupancy does not exceed the tabular allowable area values for nonsprinklered buildings found in Table 506.2.
Section 508.2 – Accessory Occupancies

Section 508.3 – Nonseparated Occupancies

Nonseparated Occupancies

For 1 sq m (10 sq ft) = 0.108 sq m.
Solution: Nonseparated Occupancies

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Allowable Height (stories)</th>
<th>Allowable Area (square feet)</th>
<th>Sprinkler System</th>
<th>Fire Alarm System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A-2</td>
<td>3</td>
<td>28,500</td>
<td>Yes</td>
<td>??</td>
</tr>
<tr>
<td>Group B</td>
<td>4</td>
<td>89,900</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Group M</td>
<td>3</td>
<td>37,500</td>
<td>Yes</td>
<td>??</td>
</tr>
</tbody>
</table>

- The building does not exceed three stories in height, does not exceed 28,500 square feet per story, and is fully sprinklered. If it is provided with a manual fire alarm system throughout, it would comply as a nonseparated occupancy building.

Section 508.4 – Separated Occupancies

Separated Occupancies
### Solution: Separated Occupancies

**Solution:** Apply the unity formula of Section 508.4.2 to determine compliance with allowable area.

#### Table: Tabular Area

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Tabular Area (square feet)</th>
<th>Frontage Increase (square feet)</th>
<th>Allowable Area (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A-2</td>
<td>38,000</td>
<td>2,375</td>
<td>40,375</td>
</tr>
<tr>
<td>Group B</td>
<td>92,000</td>
<td>5,750</td>
<td>97,750</td>
</tr>
<tr>
<td>Group M</td>
<td>50,000</td>
<td>3,125</td>
<td>53,125</td>
</tr>
</tbody>
</table>

**Equation:**

1. $100 \times 100 = 10,000$ square feet
2. $200 \times 50 = 10,000$ square feet
3. $300 \times 33 = 9,900$ square feet
4. $400 \times 25 = 10,000$ square feet

\[ \text{Allowable Area} = 100 \times 100 = 10,000 \text{ square feet} \]

#### Solution:

Apply the unity formula of Section 508.4.2 to determine compliance with allowable area.

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### Section 510 Special Provisions

- **Section 510.2** where minimum 3-hour horizontal assembly (podium) must be provided to 'separate' the buildings. Other conditions addressed in Section 510 include:
  - **Section 510.3** for a Group S-2 enclosed parking garage with a Group S-2 open parking garage above.
  - **Section 510.4** applicable to parking beneath a Group R occupancy.
  - **Section 510.7** for an open parking garage beneath a Group A, I, B, M or R occupancy.
  - **Section 510.8** where a Group B or M occupancy is located below a Group S-2 open parking garage.
Chapter 7
This chapter contains provisions for building elements and protection features such as:

- Structural members.
- Exterior walls.
- Fire walls.
- Fire barriers.
- Fire partitions.
- Smoke barriers.
- Smoke partitions.
- Horizontal assemblies.
- Vertical openings.
- Shaft enclosures.
- Penetrations.
- Fire-resistant joints.
- Opening protectives.
- Ducts and air transfer openings.
- Concealed spaces.
- Fireblocking/draftstopping.
- Prescriptive and calculation methods for determining fire-resistance rating.

Fire-Resistance Ratings and Fire Tests
The code distinguishes between two fundamental types of ratings for these assemblies:

- Fire resistance.
- Fire protection.

Collectively, they provide fire-resistant construction.

Fire-Resistance Ratings and Fire Tests
For the specified hourly rating, the conditions of acceptance for walls ensure that the assemblies will at least:

- Withstand fire exposure based on a standard time-temperature curve without passage of flames or gases hot enough to ignite cotton waste on the unexposed side.
- Withstand thermal shock of a fire hose stream test on the exposed side after the fire test.
- Limit transmission of heat during the fire test to a maximum average of 250°F (121°C) above the initial temperature on the unexposed side.
- Sustain applied loads during the fire test at load-bearing assemblies, where applicable.
**Fire-Resistance Ratings and Fire Tests**

- **Fire-protection rating** applies to opening protective assemblies (i.e., doors and windows). Fire tests are conducted in accordance with NFPA 252, UL 10B or UL 10C for doors, and NFPA 257 or UL 9 for windows, as applicable (Section 716.5 and 716.6).
- For the specified hourly rating, their conditions of acceptance all ensure that the assembly will at least withstand fire exposure and, typically, thermal shock, the same as specified for walls.

**Section 703.2 – Fire-resistance Ratings**

**Section 703.3 – Methods for Determining Fire-resistance**

- Fire tests in accordance with ASTM E119 or UL 263.
- The use of prescriptive (i.e., generic) designs contained in Section 721.
- The use of proprietary designs [i.e., testing by a Nationally Recognized Testing Laboratory (NRTL) per ASTM E119, UL 263, or equivalent].
- Calculations in accordance with Section 722.
- Engineering analysis based on a comparison of designs having a fire-resistance rating in accordance with ASTM E119 or UL 263.
- Fire-resistance designs certified by an approved agency.
- Alternative methods in accordance with Section 104.11 (alternative materials, design and methods of construction and equipment).

**Section 703.5 – Noncombustibility Tests**

- Thermocouple installation.
- Combustibility determination.
- Observation of heat and smoke release.
- Use of smoke detector.
- Evaluation of smoke and visual obscuration.
- Wood test-stand.
- Heat release determination.
- Smoke release determination.
- Use of smoke detector.
- Electrical test equipment.
Fire and Smoke Protection Features

- 703.6 – Fire-resistance-rated glazing
- 703.7 – Marking and identification
- 704 – Structural members

Section 705 – Exterior Walls

Section 705.2 – Projections
Section 705.3 – Buildings on the Same Lot

Buildings 1 and 2 regulated as two separate and distinct buildings.

Buildings 1 and 2 regulated as portions of a single building.

Section 705.5 – Fire-resistance Ratings

Lot Line

Rated for exposure to fire from both sides:

Rated for exposure to fire from one side:

For Sl. 1 ft = 30k ft.

115

116

117
Section 705.8 Maximum Area of Exterior Wall Openings

<table>
<thead>
<tr>
<th>Table 705.8</th>
<th>Maximum Area of Exterior Wall Openings</th>
<th>Size of Opening, Diam. or</th>
<th>Area of Opening</th>
<th>Resistance Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 10, 12</td>
<td>Nonrated, Noncombustible 3/4&quot; Glass</td>
<td>38'/11.6</td>
<td>No. 60 Fire</td>
<td>60</td>
</tr>
<tr>
<td>No. 4</td>
<td>Nonrated, Noncombustible 3/4&quot; Glass</td>
<td>12'/3.6</td>
<td>No. 60 Fire</td>
<td>60</td>
</tr>
<tr>
<td>No. 10, 12</td>
<td>Nonrated, Noncombustible 3/4&quot; Glass</td>
<td>15'/4.6</td>
<td>No. 60 Fire</td>
<td>60</td>
</tr>
<tr>
<td>No. 10, 12</td>
<td>Nonrated, Noncombustible 3/4&quot; Glass</td>
<td>20'/6.1</td>
<td>No. 60 Fire</td>
<td>60</td>
</tr>
<tr>
<td>No. 10, 12</td>
<td>Nonrated, Noncombustible 3/4&quot; Glass</td>
<td>24'/7.3</td>
<td>No. 60 Fire</td>
<td>60</td>
</tr>
</tbody>
</table>

Section 705.11 – Parapets

For 1.0 inch / 25.4 mm:
For 0.75 inch / 19.1 mm:

Section 706 – Fire Walls

1/2" Min. Air space, 2 layers
1" proprietary Type X gypsum panels
2" and 4 in. X 4 in.
Section 707 – Fire Barriers

Section 708 – Fire Partitions

It is limited in scope to the following required locations:

- Walls separating dwelling units from each other (Section 420.2).
- Walls separating sleeping units from each other (Section 420.2).
- Walls separating dwelling units and sleeping units from other occupancies in the same building (Section 420.2).
- Walls separating tenant spaces in covered and open mall buildings (Section 402.4.2.1).
- Corridor walls required to be fire-resistance rated (Section 1020.1).
- Elevator lobby separations (Section 3006.2).
- Egress balconies (Section 1021.2)

Section 709 – Smoke Barriers

Smoke barriers are required at, intended for, or are a design option for the following:

- Compartmentation of underground buildings (Section 405.4).
- Compartmentation of Group I-2 (Section 407.5).
- Compartmentation of Group I-3 (Section 408.6).
- Compartmentation of Group I-1, Condition 2 (Section 420.6).
- Compartmentation of ambulatory care facilities (Section 422.3).
- Smoke control systems (Section 909.5).
- Areas of refuge (Section 1009.6.4).
- Fire service access elevator lobbies (Section 3007.6.2).
- Occupant evacuation elevator lobbies (Section 3008.6.2).
Section 710 – Smoke Partitions

- The provisions of Section 710 are only applicable where other sections of the IBC specifically mandate the use of smoke partitions:
  - Section 407.3 addressing corridor walls in Group I-2 occupancies
  - Section 3006.3, Exception 2 dealing with elevator lobbies
- Smoke partitions are not required to have a fire-resistance rating unless required by some other provision of the code. Smoke partitions must be capable of resisting the passage of smoke.

Section 711 – Horizontal Assemblies

Section 712 – Vertical Openings

A summary of the acceptable applications listed in Section 712 are:
- Openings contained entirely within a shaft enclosure complying with Section 713.
- Openings totally within an individual residential dwelling unit where connecting four stories or less.
- Escalator openings if protected appropriately and the building is provided with an automatic sprinkler system.
- Penetrations by pipes, tubes, conduits, etc., protected in accordance with Section 714.
- Joints protected in accordance with Section 715.
- Openings for ramps, elevators and mechanical exhaust or supply ducts, in parking garages.
- Penetrations by ducts protected in accordance with Section 717.6.
Section 712 – Vertical Openings

A partial summary of the acceptable applications listed in Section 712 are:

- Shaft enclosures complying with Section 713.
- Penetrations by grease ducts protected in accordance with the IMC.
- Atriums complying with Section 404 (other than Group H).
- Floor openings connecting only two stories (with limitations).
- Automobile ramps in parking garages constructed in accordance with Section 406.5 or 406.6.
- Floor openings between a mezzanine and the floor below.
- Openings at exit access stairways and ramps in accordance with Section 1019.
- Horizontal fire door assemblies and access doors where tested and labeled.

Section 713 – Shaft Enclosures

- Shaft enclosures are one of the multiple applications set forth in Section 712.1 to address openings and penetrations that occur in floor/ceiling and roof/ceiling assemblies of multistory buildings.
- Such enclosures are to be constructed through the use of fire barriers, or horizontal assemblies, or both.

Section 714 – Penetrations

- Membrane penetration firestop systems are generally not tested, instead they consist of the portions of through-penetration firestop systems required to protect a penetration on only one side of an assembly.
Section 714 – Penetrations

Section 715 – Joint Systems

Section 716 – Opening Protectives

- Where opening protectives (fire doors, fire shutters and fire windows) are mandated by other provisions of the IBC, the provisions of Section 716 are applicable.
- As an option, fire-resistance-rated glazing tested as part of a wall assembly in accordance with ASTM E119 or UL 263 is permitted in fire windows and fire doors in accordance with their listings and not required to meet the provisions of Section 716.
### Table 716.1(2) – Fire Door and Fire Shutter Assemblies

<table>
<thead>
<tr>
<th>Rating Level</th>
<th>Intact</th>
<th>1 Hour</th>
<th>2 Hours</th>
<th>3 Hours</th>
<th>4 Hours</th>
<th>5 Hours</th>
<th>6 Hours</th>
<th>Fire Shutter Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10</td>
<td>16</td>
<td>21</td>
<td>26</td>
<td>31</td>
<td>36</td>
<td>41</td>
<td>No Provision</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>42</td>
<td>48</td>
<td>54</td>
<td>No Provision</td>
</tr>
<tr>
<td>C</td>
<td>26</td>
<td>32</td>
<td>38</td>
<td>44</td>
<td>50</td>
<td>56</td>
<td>62</td>
<td>No Provision</td>
</tr>
</tbody>
</table>

### Table 716.1(3) – Fire-protection-rated Glazing

<table>
<thead>
<tr>
<th>Rating Level</th>
<th>Intact</th>
<th>1 Hour</th>
<th>2 Hours</th>
<th>3 Hours</th>
<th>4 Hours</th>
<th>5 Hours</th>
<th>6 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>42</td>
<td>48</td>
<td>54</td>
</tr>
<tr>
<td>B</td>
<td>26</td>
<td>32</td>
<td>38</td>
<td>44</td>
<td>50</td>
<td>56</td>
<td>62</td>
</tr>
</tbody>
</table>

### Section 717 – Ducts and Air Transfer Openings

<table>
<thead>
<tr>
<th>Type of Penetration</th>
<th>Fire Damper Rating (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 3-hour fire-resistance-rated assemblies</td>
<td>1.5</td>
</tr>
<tr>
<td>3-hour or greater fire-resistance-rated assemblies</td>
<td>3</td>
</tr>
</tbody>
</table>
Section 803 – Wall and Ceiling Finishes

Wall and ceiling finishes have limits on flame spread and smoke development, except for:

- Materials less than 0.036-inches thick (0.914 mm) applied directly to the surface of walls or ceilings (Sec. 803.2)
- Exposed portions of heavy timber members, except in interior exit stairways and exit passageways (Sec. 803.3)
- Floor finishes having a limited critical radiant flux (Sec. 804)
- Trim and decorative materials that are regulated for flame resistance (Section 806).

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Section 803 – Wall and Ceiling Finishes

Wall and ceiling finishes are to be classified for fire performance and smoke development per:

- NFPA 286, which is considered to meet the Class A requirements (Sec. 803.1.1), or
- ASTM E84 or UL 723, which groups finishes into Class A, B and C classes (Sec. 803.1.2)
- Additional criteria for special conditions (Sec. 803.1.3 through 803.15, including provisions addressing:
  - Textile wall and ceiling coverings
  - Expanded vinyl wall and ceiling coverings
  - Site-fabricated stretch systems
  - Laminated products, facings and wood veneers

Section 803.13 – Interior Finish Requirements Based on Groups

Table 803.11 specifies the minimum required classification for wall and ceiling finishes based on occupancy classification and automatic sprinkler protection for the following locations:

- Interior exit stairways, interior exit ramps and exit passageways,
- Corridors and enclosure for exit access stairways, or
- Rooms and enclosed spaces (i.e., not included in the first two items).
Section 804 – Interior Floor Finish Requirements

- Fibrous interior floor finishes in enclosures for stairways, exit passageways, corridors and rooms not separated from corridors by full-height partitions must also meet the following minimum classifications:
  - Class I for Groups I-1, I-2 and I-3 in a nonsprinklered building.
  - Class II for Groups I-1, I-2 and I-3 in a fully sprinklered building.
  - Class II for Groups A, B, E, H, I-4, M, R-1, R-2 and S in a nonsprinklered building.

General Requirements for Fire Protection Systems

- Fire protection systems are to be installed, repaired, operated and maintained in accordance with the IBC and the IFC.
- Systems not required by the IBC are permitted to be installed for partial or complete protection, provided such systems meet the requirements of the IBC.
- Any system for which an exception to, or reduction in, the provisions of the IBC has been granted must be considered a required system.
- No person is permitted to remove or modify any system without the approval of the building official.
- All systems must be tested in accordance with the requirements of the IBC and IFC in the presence of the building official and at the expense of the owner or owner’s representative.
- It is unlawful to occupy portions of a structure until the required fire protection systems within that portion have been tested and approved.
Fire Sprinklers in Group A

- Where fire sprinklers are required in a Group A occupancy located on a story other than LED, fire sprinklers must be installed on all stories leading to all levels of exit discharge that are used by the Group A occupancy.

§903.2.1.1, 903.2.1.2, 903.2.1.3, 903.2.1.4.

Group A-1
§903.2.1.1

- Fire sprinklers required and throughout all stories from the Group A-1 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:
  - Fire area >12,000 ft²
  - Fire area has an OL ≥300
  - Fire area is located on a level other than LED
  - Fire area contains a multitheater complex

Group A-2
§903.2.1.2

- Fire sprinklers required and throughout all stories from the Group A-2 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:
  - Fire area >5,000 ft²
  - Fire area has an OL ≥100
  - Fire area is located on a level other than LED
Group A-3 & A-4
§903.2.1.3, §903.2.1.4
- Fire sprinklers required and throughout all stories from the Group A-3, A-4 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area has OL ≥300
  - Fire area is located on a level other than LED

Group A-5
§903.2.1.5
- Fire sprinklers required in the following areas in excess of 1,000 ft² that are accessory to stadiums or arenas:
  - Concession areas
  - Retail areas
  - Press boxes

Group A-5
§903.2.1.5.1
- 903.2.1.5.1 Spaces under grandstands or bleachers.
  - Enclosed spaces under grandstands or bleachers shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 where either of the following exist:
    1. The enclosed area is 1,000 square feet (93 m²) or less and is not constructed in accordance with Section 1029.1.1.1.
    2. The enclosed area exceeds 1,000 square feet (93 m²).
 Assembly Occupancies on Roofs
§903.2.1.6
• Fire sprinklers are required on all floors between an occupied roof and the LED discharge where assembly uses occur on the rooftop and:
  • OL >100 for Group A-2, or
  • OL >300 for other Group A occupancies

 Multiple Group A Fire Areas
§903.2.1.7
• Sprinklers required where multiple fire areas contain Group A-1, A-2, A-3 or A-4 occupancies that share egress components and OL ≥300

 Ambulatory Care Facilities
§903.2.2
• Fire sprinklers required on floors with a Group B Ambulatory Care Facility when:
  • ≥4 care recipients incapable of self-preservation
  • ≥1 care recipients incapable of self-preservation on a floor other than LED

§903.3.2 requires the installation of QR or residential sprinklers throughout smoke compartments containing treatment rooms

How do you determine the number of care recipients?
Count the beds
Ambulatory Care Facilities

§903.2.2

- In buildings where ambulatory care is provided on levels other than the level of exit discharge, an automatic sprinkler system shall be installed throughout the entire floor as well as all floors below where such care is provided, and all floors between the level of ambulatory care and the nearest level of exit discharge, the level of exit discharge, and all floors below the level of exit discharge.

- Exception: Floors classified as an open parking garage are not required to be sprinklered.

Group E

§903.2.3

- Fire sprinklers required in the occupancy when one of the following conditions exist:
  1. Fire area >12,000 ft²
  2. All portions below LED
     - Sprinklers not required in areas below LED where each classroom has at least one exterior exit door at ground level
  3. The Group E fire area has an occupant load of >300

Group F-1

§903.2.4

- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area is >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for manufacture of upholstered furniture or mattresses >2,500 ft²
Woodworking Operations
§903.2.4.1
- Fire sprinklers required throughout the building where both of the following conditions exist:
  - Fire area >2,500 ft²
  - The process generates finely divided waste or uses finely divided combustible materials

Group H
§903.2.5
- Fire sprinklers required in all Group H occupancies
- §5004.5 requires systems to meet Ordinary Hazard Group 2 criteria, at minimum with 3,000 ft² design area
  - 0.17 gpm/ft²
  - Many materials require more water

Group H-5
§903.2.5.2
- Fire sprinklers required throughout the building
- IFC Table 903.2.5.2 establishes minimum design criteria for automatic sprinklers based on the location in the building

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Group I
§903.2.6
- Fire sprinklers required throughout the building
- §903.2.6 allows the installation of NFPA 13R systems in Group I-1 Condition 1
- §903.2.6 requires the installation of QR or residential sprinklers in:
  - All areas of smoke compartments containing care recipient sleeping units in Group I-2
  - Sleeping units in Group I-1

Group M
§903.2.7
- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for display and sale of upholstered furniture or mattresses >5,000 ft²

Group R
§903.2.8
- Fire sprinklers required throughout the building for all Group I occupancies
- NFPA 13D systems in Group R-3, R-4 Condition 1 and care facilities with ≤5 clients
- NFPA 13R systems in Group R-4 Condition 2
- §903.2.8 requires the installation of QR or residential sprinklers in:
  - 1- & 2-family dwellings and townhomes built under the IRC
  - 1- & 2-family dwellings in accordance with the IRC or NFPA 13D
Pedestal/Podium Construction
IBC §510.4

- Group R occupancies with parking beneath
- Depending on the construction and the building's height and area, the design of the sprinkler system may be based on NFPA 13, 13R or a combination of NFPA 13 and 13R.

Pedestal/Podium Construction

3-HR horizontal assembly
Number of stories for Group R
Building height
Any occupancy other than Group H
Type IA construction
NFPA 13R for Group R IF
54 stories AND
height is ≤60'

Pedestal/Podium Construction

NFPA 13 for Group R IF
>4 stories OR
height is >60'
Group S-1
§903.2.9
- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area is >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for storage of upholstered furniture or mattresses >2,500 ft²
  - The storage of commercial trucks or buses when the fire area is >5,000 ft²

Group S-1 Repair Garages
§903.2.9.1
- Fire sprinklers required throughout the building when one of the following conditions exist:
  - Building is 1 story and fire area >12,000 ft²
  - Building is ≥ 2 stories and fire area >10,000 ft²
  - Repair garage is located in a basement
  - Repair garage for commercial trucks or buses and the fire area is >5,000 ft²

Group S-1 Storage of Tires
§903.2.9.2
- Fire sprinklers required when:
  - Fire area >20,000 cubic feet

Would this be considered high-piled combustible storage?
Group S-2 Enclosed Parking Garage
§903.2.10
- Fire sprinklers required when:
  - Fire area >12,000 ft²
  - Parking garage is located beneath another occupancy

Section 901.7 – Fire Areas

Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required throughout all buildings containing the following occupancies:
- Group H-5
- Group I
- Group R

An automatic sprinkler system is required throughout the occupancy for the following occupancies:
- Groups H-1, H-2, H-3 and H-4
Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required throughout all buildings, containing the following occupancies:

- Groups F-1, M and S-1
  - Also required to and including the level of exit discharge
  - Required where:
    - Fire area exceeds 12,000 square feet, or
    - Combined area of all fire areas on all floors exceeds 24,000 square feet, or
    - Fire area located more than three stories above grade plane

Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required throughout all stories, containing the following occupancies:

- Groups A-1, A-2, A-3 and A-4
  - Also required to and including the level of exit discharge
  - Required where:
    - Fire area exceeds 12,000 square feet, or
    - Fire area has an occupant load of 300 or more (100 or more in Group A-2), or
    - Fire area located on a floor other than the level of exit discharge.

Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required throughout all fire areas, containing the following occupancy:

- Groups E
  - Required where:
    - Fire area exceeds 12,000 square feet, or
    - Fire area has an occupant load of 300 or more, or
    - Fire area located on a floor other than the level of exit discharge.
### Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required:
- **Group A-5**: all enclosed accessory use areas exceeding 1,000 square feet
- **Group B**: ambulatory care facilities where:
  - Four or more care recipients incapable of self-preservation
  - One or more care recipients incapable of self-preservation are located at other than the level of exit discharge
- In numerous other applications, such as:
  - Assembly occupancies on roofs
  - High-piled storage areas
  - Repair garages
  - Enclosed parking garages

### Application Matrix of the NFPA Sprinkler Standards

<table>
<thead>
<tr>
<th>NFPA Standard</th>
<th>NFPA 13</th>
<th>NFPA 13R</th>
<th>NFPA 13D (IBC P2904)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extent of Protection</strong></td>
<td>Throughout the building (IFC Section 903.3.1.1)</td>
<td>Occupied spaces (IFC Section 903.3.1.2)</td>
<td>Occupied spaces (IFC Section 903.3.1.3)</td>
</tr>
<tr>
<td><strong>Design Intent</strong></td>
<td>Life safety and property protection</td>
<td>Life safety</td>
<td>Life safety</td>
</tr>
<tr>
<td><strong>Applicability</strong></td>
<td>All IBC and NFPA occupancies</td>
<td>Grilled P occupancies for a studio</td>
<td>One and two family Dwellings and townhomes</td>
</tr>
<tr>
<td><strong>Design Methods</strong></td>
<td>Pipe schedule, control valve—discharge density, design area; control mode—specific application requirements initiate</td>
<td>Pipe schedule, control valve—discharge density, design area; control mode—specific application requirements initiate</td>
<td>4 sprinklers, compartment</td>
</tr>
<tr>
<td><strong>Sprinklers</strong></td>
<td>All listed and approved types</td>
<td>Listed residential</td>
<td>Listed residential</td>
</tr>
<tr>
<td><strong>Minimum FLO Supply Duration</strong></td>
<td>30 to 120 minutes, depending on the design</td>
<td>30 minutes</td>
<td>16 minutes</td>
</tr>
</tbody>
</table>

### Section 903.2.11.1 – Automatic Sprinkler Systems
1. Fire Area Activity

2. Fire Area Activity

3. Fire Area Activity
4. Fire Area Activity

5. Fire Area Activity

Section 904 – Alternative Automatic Fire-extinguishing Systems
Section 905 – Standpipe Systems

- There are 3 classes of standpipes:
  - Class I – 2½-inch connections
  - Class II – 1½-inch connections
  - Class III – Both 1½-inch and 2½-inch connections

### Required Standpipe Installations

<table>
<thead>
<tr>
<th>Location of Use</th>
<th>Nonrequired Buildings</th>
<th>Required Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building of 4 or more stories or where highest story located more than 30 feet above LLFDVA</td>
<td>Class I</td>
<td>Class III</td>
</tr>
<tr>
<td>Building of 4 or more stories or where highest story located more than 30 feet above HLFDVA</td>
<td>Class I</td>
<td>Class III</td>
</tr>
<tr>
<td>Group B occupancies with conveyor belt exceeding 2,000 ft</td>
<td>Class I</td>
<td>Nonrequired</td>
</tr>
<tr>
<td>General wall buildings</td>
<td>Class I</td>
<td>Class III</td>
</tr>
<tr>
<td>Sagging area less than 1,000 square feet (93 m²)</td>
<td>Class I</td>
<td>Class III</td>
</tr>
<tr>
<td>Undeveloped buildings</td>
<td>Class I</td>
<td>Class III</td>
</tr>
</tbody>
</table>

1. Class I standpipes permitted as a means of egress on certain public buildings.
2. Class I standpipes permitted in certain public buildings, where safety equipment, such as elevators, is required to be in the building.
3. Class I standpipes permitted in certain public buildings, where safety equipment, such as elevators, is required to be in the building.
4. Class I standpipes permitted in certain public buildings, where safety equipment, such as elevators, is required to be in the building.
5. Class I standpipes permitted in certain public buildings, where safety equipment, such as elevators, is required to be in the building.
6. Class I standpipes permitted in certain public buildings, where safety equipment, such as elevators, is required to be in the building.

Section 906 – Fire Extinguishers

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type of Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>Fires involving ordinary combustibles such as paper, cloth, etc.</td>
</tr>
<tr>
<td>Class B</td>
<td>Fires involving combustible or flammable liquids and gases.</td>
</tr>
<tr>
<td>Class C</td>
<td>Fires involving energized electrical equipment—the extinguishing agent must be nonconductive.</td>
</tr>
<tr>
<td>Class D</td>
<td>Fires involving combustible metals such as titanium, magnesium.</td>
</tr>
<tr>
<td>Class K</td>
<td>Fires involving deep fat frys.</td>
</tr>
</tbody>
</table>
## Section 907 – Fire Alarm and Detection Systems

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>CONDITIONS</th>
<th>SYSTEM TYPE</th>
<th>EXCEPTIONS</th>
<th>SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Occupant load &gt; 300, or &gt; 100 above or below discharge level</td>
<td>Manual fire alarm system</td>
<td>1</td>
<td>907.2.1</td>
</tr>
<tr>
<td></td>
<td>Occupant load &gt; 1,000</td>
<td>Emergency intercommunication (EIIC) system</td>
<td>2</td>
<td>907.2.1.1</td>
</tr>
<tr>
<td>B</td>
<td>Occupant load &gt; 500, or &gt; 100 above or below discharge level</td>
<td>Manual fire alarm system</td>
<td>1</td>
<td>907.2.2</td>
</tr>
<tr>
<td></td>
<td>Ambulatory care facilities</td>
<td>Electronically supervised automatic smoke detection system</td>
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<th>SYSTEM TYPE</th>
<th>EXCEPTIONS</th>
<th>SECTIONS</th>
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<tbody>
<tr>
<td>1</td>
<td>Occupant load &gt; 1,000</td>
<td>Manual fire alarm system</td>
<td>1, 3</td>
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<td>EVA system</td>
<td>None</td>
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<td>F</td>
<td>Two or more stories, and &gt; 500 above or below discharge level</td>
<td>Manual fire alarm system</td>
<td>1</td>
<td>907.2.4</td>
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<tr>
<td>H</td>
<td>B-2 apartments, organic contents are manufactured</td>
<td>Manual fire alarm system</td>
<td>None</td>
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<td></td>
<td>Highly toxic gases, organic periciles and amenities</td>
<td>Automatic smoke detection system</td>
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<td>Automatic smoke detection system</td>
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<td>Contain in Group II Condition 1 facilities and spaces open to corridors</td>
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Section 907 – Fire Alarm and Detection Systems

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<th>Manual/Fireworks system</th>
<th>Automatic detection system</th>
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<tr>
<td>3</td>
<td>300 or more</td>
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</tr>
</tbody>
</table>

Section 910 – Smoke and Heat Removal

- Approved smoke and heat vents or mechanical smoke removal system must be installed in roofs of one-story buildings, or portions thereof, occupied for the following uses:
  - Group F-1 or S-1 having more than 50,000 square feet (4645 m²) in undivided area (exceptions for aircraft repair hangars, sprinklered frozen-food warehouses and areas of buildings equipped with early suppression, fast response (ESFR) sprinklers).
  - Any occupancy containing high-piled combustible stock or rack storage in accordance with Section 413 and the IFC.
Section 911 – Fire Command Center

- Fire department communications unit.
- Fire detection and alarm system annunciator unit.
- Status indicators and controls for air-handling systems.
- Controls for unlocking stairway doors simultaneously.
- Emergency and standby power status indicators.

Section 911 – Fire Command Center

- Fire pump status indicators.
- Schematic building plans.
- Manual start and transfer features.
- Elevator fire recall switch.
- Approved “Building Card Information”
Chapter 10 – Means of Egress

Exit Access

Exit
Exit Discharge

Three-part means of egress systems

1. Interior exit stairway __________ E
2. Aisle accessway ____________ EA
3. Egress court ____________ ED
4. Fire-resistance-rated corridor ____________ EA
5. Aisle ____________ EA
6. Exit passageway __________ E
7. Exterior exit stairway __________ E
8. Intervening room __EA
9. Egress balcony ____________ EA
10. Nonrated corridor ____________ EA
11. Interior unenclosed stairway ____________ E
12. Exterior exit door at grade ____________ E
13. Horizontal exit ____________ E

Section 1003 - General Means of Egress
Section 1004.2 - Cumulative Occupant Loads

- Mezzanine occupant load to be added to room area or space below
- Occupant load from adjacent stories not to be added

Section 1004.5 – Occupant Loads for Areas w/o Fixed Seating

1004.5.1 – Increased Occupant Load

For SI: 1 ft² = 0.093 m², 1 linear ft = 0.093 m
Section 1005.3 – Means of Egress Required Capacity

- The total width of the means of egress in inches (mm) must not be less than the total occupant load served by the means of egress multiplied by:
  - 0.3 inches (7.62 mm) per occupant for stairways (0.2 inches with sprinkler and EV/AC systems), and
  - 0.2 inches (5.08 mm) per occupant for other egress components (0.15 inches with sprinkler and EV/AC systems).

### Exiting from Multiple Stories

<table>
<thead>
<tr>
<th>Exit Element</th>
<th>Occupant Load Served</th>
<th>Required Width</th>
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<tbody>
<tr>
<td>Main Entrance</td>
<td>200</td>
<td>90'</td>
</tr>
<tr>
<td>Stair/Plant A</td>
<td>150</td>
<td>87'</td>
</tr>
<tr>
<td>Stair/Plant B</td>
<td>150</td>
<td>45'</td>
</tr>
<tr>
<td>Stair/Plant C</td>
<td>150</td>
<td>72'</td>
</tr>
<tr>
<td>Stair/Plant D</td>
<td>150</td>
<td>72'</td>
</tr>
<tr>
<td>Stair/Plant E</td>
<td>150</td>
<td>72'</td>
</tr>
<tr>
<td>Exit door from stair enclosure E</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Exit door from stair enclosure F</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

1. Required width from above must be maintained.
2. Door at point E serves occupants from C and D egress on either side per Section 1009.8

### Occupant Load

1. What is the occupant load for a place of worship seating area having 40 pews, each pew being 18 feet (5486 mm) in length?

   \[ 18' / 1.5' = 12 \times 24 = 288 \text{ occupants} \]

   (Section 1004.6)
Occupant Load

2. What is the minimum required egress width for a one-story sprinklered Group M occupancy having an occupant load of 878?

   Without EV/AC system; Group M:
   878 (0.2) = 175.6 inches (4460 mm)
   With EV/AC system; Group M:
   878 (0.15) = 131.7 inches (3345 mm)

Occupant Load

3. What is the total required exit stairway width for a second floor office space having an occupant load of 330 in a nonsprinklered building?

   Nonsprinklered; Group B;
   330 (0.3) = 99.0 inches (2515 mm)

Occupant Load

4. Determine the design occupant load:
   a. 32,000-square-foot (2973 m²) factory
      \[
      \frac{32,000}{100} = 320 \text{ occupants}
      \]
   b. 2,400-square-foot (112 m²) sales room (grade floor)
      \[
      \frac{2,400}{30} = 80 \text{ occupants}
      \]
   c. 1,200-square-foot (112 m²) apartment unit
      \[
      \frac{1,200}{200} = 6 \text{ occupants}
      \]
Section 1005.7.1 – Door Encroachment

Application Example

Section 202 – Common Path of Egress Travel
### 1006.2.1 – Spaces with One Exit or Exit Access Doorway

<table>
<thead>
<tr>
<th>Building/Structure</th>
<th>Stability Factor</th>
<th>Total Floor Area (SF)</th>
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<td>0.7</td>
<td>250,000 SF</td>
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<tr>
<td>B, C</td>
<td>0.5</td>
<td>100,000 SF</td>
</tr>
<tr>
<td>D, M, C, L</td>
<td>0.7</td>
<td>50,000 SF</td>
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</table>

### Table 1006.3.3(1) – Stories with One Exit or Access to One Exit for Group R-2 Occupancies

<table>
<thead>
<tr>
<th>Stories with One Exit or Access to One Exit for Group R-2 Occupancies</th>
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<tbody>
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<td>Stories with One Exit or Access to One Exit for Group R-2 Occupancies</td>
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<td>Stories with One Exit or Access to One Exit for Group R-2 Occupancies</td>
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<td>Stories with One Exit or Access to One Exit for Group R-2 Occupancies</td>
</tr>
<tr>
<td>Stories with One Exit or Access to One Exit for Group R-2 Occupancies</td>
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</tbody>
</table>

### Table 1006.3.3(2) – Stories with One Exit or Access to One Exit for Other Than Group R-2 Occupancies

<table>
<thead>
<tr>
<th>Stories with One Exit or Access to One Exit for Other Than Group R-2 Occupancies</th>
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<tbody>
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<td>Stories with One Exit or Access to One Exit for Other Than Group R-2 Occupancies</td>
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<tr>
<td>Stories with One Exit or Access to One Exit for Other Than Group R-2 Occupancies</td>
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<th>Stories with One Exit or Access to One Exit for Other Than Group R-2 Occupancies</th>
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<tr>
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<tr>
<td>Stories with One Exit or Access to One Exit for Other Than Group R-2 Occupancies</td>
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</tbody>
</table>
Section 1007 – Exit and Exit Access Configuration

Section 1008 – Means of Egress Illumination

Section 1009 – Accessible Means of Egress
Section 1010.1.1 – Size of Doors

MINIMUM HEIGHT 6'-0" (1828 mm)

MAXIMUM WIDTH 4'-0" (1219 mm)

MINIMUM WIDTH AND CAPACITY SUFFICIENT FOR OCCUPANT LOAD PROVIDED MINIMUM 3'-0" (914 mm) CLEAR WIDTH

Section 1010.1.2 – Door Swing

Pivoted or side-hinged swinging doors to swing in direction of egress travel where serving a room or area containing:
• 50 or more persons, or
• a Group H occupancy
Section 1010.1.4 – Special Doors

- Revolving doors
- Power-operated doors
- Horizontal sliding doors
- Locking arrangements in education occupancies
- Security grilles

Section 1010.1.9 – Door Operations

- Egress doors should be readily openable from the egress side without the use of a key, special effort or knowledge.

Exception 2

Swinging doors provided with a latch or lock shall be provided with panic hardware where serving:
- 50 or more persons in a Group A or E occupancy, or
- a Group H occupancy
Section 1011.2 – Stairway Width and Capacity

For N=1 each 3 ft. linear.

Section 1011.5 – Stair Treads and Risers

For 31.5 inch > 36.5 linear.

Section 1011.6 – Stairway Landings

For 31.5 inch > 36.5 linear.
Sections 1011.9 through 1011.15—Alternate Stairways

Section 1011.11 – Handrails

Section 1014.3 – Handrail Graspability
Section 1014.3 – Handrail Graspability

Section 1014.6 – Handrail Extensions

Section 1012 – Ramps
Section 1013 – Exit Signs

Section 1013.6.3 – Power Source

Section 1015 – Required Guards
**Section 1015.3 – Guard Height**

Exception: In 7-0 occupancies and within indicia-useinging units in R-3, guard height may be reduced where the top rail acts as handrail or guard.

Top rail must be horizontal or guard.

42" min.

**Section 1015.4 – Guard Opening Limitations**

4" canard plate through.

**Section 1016.2 – Egress Through Intervening Spaces**
**Section 1016.2 – Exit Through Intervening Spaces**

Kitchens, storerooms, closets or spaces used for similar purposes

- Egress not permitted
- Kitchen*, store room, closet or similar use

*Exception: Kitchen within same dwelling unit or guestroom.

---

**Section 1016.2 – Exit Through Intervening Spaces**

- Dwelling units or sleeping area
- Sleeping area, toilet room

Egress from dwelling units or sleeping areas shall not lead through other sleeping areas or toilet areas.

---

**Section 1016.2 – Exit Through Intervening Spaces**

- A High-hazard occupancy

Egress not permitted

*Exception

When space to be entered is the same occupancy group.
Section 1017 – Exit Access
Travel Distance

Distance of travel measurement continues for unenclosed stairway or ramp.

Table 1017.2 – Exit Access Travel Distance

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>WITHOUT SPRINKLER SYSTEM (ft)</th>
<th>WITH SPRINKLER SYSTEM (ft)</th>
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<tbody>
<tr>
<td>A, E, S-1</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>E-1</td>
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<tr>
<td>B</td>
<td>200</td>
<td>300</td>
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<tr>
<td>C, S-2, U</td>
<td>200</td>
<td>400</td>
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<td>H-1</td>
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<td>H-2</td>
<td>Not Permitted</td>
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<td>I-2, I-3</td>
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<td>250</td>
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<td>150</td>
<td>200</td>
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Section 1017.2.1 – Exterior Egress Balcony Increase

Table 1020.1 – Corridor Fire-Resistance Rating

Table 1020.2 – Minimum Corridor Width
Section 1020.4 – Dead Ends

Section 1020.6 – Corridor Continuity

Section 1021 – Egress Balconies

Balconies considered as a portion of the means of egress must comply with the same requirements as corridors for:
- Width.
- Headroom.
- Dead ends.
- Projections.
Section 1023 – Interior Exit Stairways and Ramps

- Interior exit stairways and ramps must be enclosed as specified in Section 1023.2.
- They shall lead directly to the exterior of the building or be extended to the building's exterior with an exit passageway.
- An interior exit stairway or ramp shall not be used for any purpose that interferes with its role as a means of egress.

Section 1023.2 – Stairway Construction

Section 1023.7 – Interior Exit Stairway and Ramp Exterior Walls
Section 1023.11 – Smokeproof Enclosures and Pressurized Stairways

- Enclosed ventilated
- Open exterior balconies
- Other ventilation alternatives

Section 1024 – Exit Passageways

- Fire door assembly with 1-hour fire protection rating in 1-hour passageway, 1/2-hour in 2-hour construction
- Minimum 1-hour fire-resistant construction, 2 hours where extending a 24-hour stairwell enclosure

*Maximum transmitted temperature < 49°C above ambient at end of time test. (Temperature was not regulated in sprinklered building)

For SI: °C = °F − 32/1.8
Section 1027 – Exterior Exit Ramps and Stairways

Section 1027.6 – Exterior Ramps and Stairway Protection

Section 1028 – Exit Discharge
Section 1029.6 – Capacity of Aisles for Assembly Seating Areas
The minimum required capacity is determined from:

- Buildings without smoke-protected seating (Section 1029.6.1).
- Buildings with smoke-protected seating (Section 1029.6.2).
- Open-air assembly seating (Section 1029.6.3).

In no case must minimum clear widths of aisles be less than those stated in Section 1029.9.1.

Section 1029.10.1 – Means of Egress for Seating at Tables

Section 1030 – Emergency Escape and Rescue Openings
Exterior emergency escape and rescue openings must be provided in:

- Group R-2 occupancies located on stories with one exit per Tables 1006.3.3(1) and 1006.3.3(2).
- Group R-3 and R-4 occupancies.

Openings are to be provided in the following areas:

- Basements.
- Sleeping rooms below the fourth story.
Table 1006.3.3(1) – Stories with One Exit or Access to One Exit for Group R-2 Occupancies

<table>
<thead>
<tr>
<th>Story</th>
<th>Group Occupancy</th>
<th>Occupant Load of</th>
<th>Minimum Size of Exit or Exit Access Wayway</th>
<th>Length or Width of Exit or Exit Access Wayway</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R-2</td>
<td>500</td>
<td>3 ft.</td>
<td>10 ft.</td>
</tr>
<tr>
<td>2</td>
<td>R-2</td>
<td>250</td>
<td>3 ft.</td>
<td>10 ft.</td>
</tr>
<tr>
<td>3</td>
<td>R-2</td>
<td>125</td>
<td>3 ft.</td>
<td>10 ft.</td>
</tr>
</tbody>
</table>

Table 1030.2 – Minimum Size

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Means of Egress Activity

1. Access to at least three exits or exit access doorways is required from a room where the occupant load exceeds 500. Section 1006.2.1.1
Means of Egress Activity

2. What is the minimum required corridor width:
   a. For access to mechanical equipment ____________________ 24 inches
   b. Within a dwelling unit ____________________ 36 inches
   c. Serving 100 or more occupants in a Group E occupancy ____________________ 72 inches
   d. For Group I-2 bed movement areas ________ 96 inches
   e. Serving an occupant load less than 50 ____________________ 36 inches

3. What is the maximum permitted travel distance, including exterior egress balcony travel, for a sprinklered Group R-1 occupancy?
   350 feet (106 680 mm), based on 250' + 100' (76 200 mm + 30 480 mm) maximum balcony travel (Table 1017.2 and Section 1017.2.1)

4. How many intermediate rails are required for a 30-foot (9144 mm) wide stair that has a required width of 18 feet 9 inches (5738 mm)?
   18’ 9” = 225”/60 — four paths - three intermediate rails (Section 1014.9)

5. How many means of egress are required from the following spaces, assuming the common path of travel is within the allowable limits?
   a. 4,000-square-foot office 4,000/150 = 26 = 1
   b. 450-square-foot conference room 450/15 = 30 = 1
   c. 6,000-square-foot warehouse 6,000/500 = 12 = 1
   d. 2,400-square-foot apartment 2,400/200 = 12 = 1
   e. 1,800-square-foot sales room 1,800/60 = 30 = 1
   f. 900-square-foot café 900/15 = 60 = 2
6. What is the minimum required width of an egress court serving a Group M occupancy?

44 inches (1118 mm) (Section 1028.4.1)

Conclusion

- Review
- Surveys
- Questions

Final Reflection

This slide will help the learner reflect on the day and what they will take back to the job and apply.

- What? What happened and what was observed in the training?
- So what? What did you learn? What difference did this training make?
- Now what? How will you do things differently back on the job as a result of this training?
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