9B Basic Course

Based on the 2020 NYS Code

19-NYCRR, Part 1208
Minimum Standards for Code Enforcement Training in NYS
Section 1208-3.2 (d)

Must be completed in the Shorter of:
18 months from the first course or
18 months from appointment as CEO or BSI

Failure to complete a basic training program within such time period shall result in the forfeiture of any and all accrued training credit unless an application for an extension is submitted, in writing, showing good cause.

Fire Safe Design

What the Code Official/Building Safety Inspector Needs to know about the theory of constructing a “Fire Safe” building.

We no longer say “Fire Proof”
Who wrote the book on Fire Safe Design?

History Continues to Write Code

MGM Grand Hotel/Casino Fire 1980
Seton Hall University Fatal Fire, New Jersey 2000
Station Nightclub Fire, Rhode Island 2003

Fire Safe Design

It's a Balanced Approach
Evaluate to Address the Risk
Passive Fire Protection
Active Fire Protection
Fire Service
Means of Egress
The Approach in this Program

What Fire Safe Design is
Why Fire Safe Design is important
How Fire Safe Design works
Where to find Fire Safe Design in the Code

Materials in the Course

The 2020 BCNYS
- Primarily a NEW construction activity code
- Links together the other Code documents

Materials in the Course

The 2020 FCNYS
- Conditions hazardous to life or property
- Installation, repair, alteration or removal of:
  - Fire Protection Equipment
  - Fire Hazards in the Structure
Typical Layout for each Code

Chapter 1: Administration
Chapter 2: Definitions
Code Requirements fill the middle chapters
Last Numbered Chapter is Referenced Standards
Appendices (see Chapter 1 for a list of adopted)

Building Code

Chapters affecting Fire Safe Design

Classification and Design
Chapter 3: Use and Occupancy Classification
Chapter 4: Special Detailed Requirements based on Use and Occupancy
Chapter 5: General Building Heights and Area
Chapter 6: Types of Construction

Building Code

Chapters affecting Fire Safe Design

Fire Safety Features
Chapter 7: Fire and Smoke Protection Features
Chapter 8: Interior Finishes
Chapter 9: Fire Protection Systems
Chapter 10: Means of Egress
Effective Use of the Building Code
starts with …

Occupancy Classification (Lesson 1)
Type of Construction (Lesson 2)
Building Height and Area (Lesson 3)
Mixed, Accessory Uses and Special Uses (Lesson 4)
Location on the Property (Lesson 5)
Lesson 1

Chapter 3
Occupancy Classifications
“Evaluating the risk”

Chapter 3: Occupancy Classifications

- Based on Similar Characteristics
- To Achieve Equivalent Safety
- Occupant Related Hazards
- Content Related Hazards

Chapter 3
Section 302.1 Occupancy Classification

- Assembly
- Institutional
- Business
- Mercantile
- Educational
- Residential
- Factory/Industrial
- Storage
- Hazardous
- Utility
- Storage
Assembly Group A

Section 303.1

A-1 Usually fixed seating, viewing, such as motion pictures
A-2 Food and or drink consumption
A-3 Worship, recreation or amusement
A-4 Viewing of indoor sporting events, with spectator seating
A-5 Viewing or participating in outdoor activities

Assembly Group A

Classified as GROUP B, or part of the occupancy they are in

303.1.1 Small buildings and tenant spaces. Accessory room or space, less than 50 people

303.1.2 Small assembly spaces. Assembly room or space, less than 750 SF Less than 50 people

Assembly Group A

Classified as GROUP B, or part of the occupancy they are in

303.1.3 Associated with Group E occupancies
   – Called Group E

303.1.4 Accessory to places of religious worship
   – Educational rooms same occupancy as church
### Business Group B

**Section 304.1**

Office, professional or service type transactions, including storage of records and accounts.

<table>
<thead>
<tr>
<th>Group B Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>304.1 - “Training and Skill Development”</strong></td>
</tr>
<tr>
<td>• Tutoring Centers</td>
</tr>
<tr>
<td>• Martial Arts Studio</td>
</tr>
<tr>
<td>• Gymnastics and similar uses</td>
</tr>
</tbody>
</table>

No age limit

Is not classified as a Group A

<table>
<thead>
<tr>
<th>Group B Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>304.1 - “Food processing establishments and commercial kitchens”</strong></td>
</tr>
<tr>
<td>Not associated with a restaurant, or similar dining facility</td>
</tr>
<tr>
<td>Food is prepared for carry-out purposes</td>
</tr>
<tr>
<td>Not more than 2,500 sq. ft. in area</td>
</tr>
</tbody>
</table>
Educational Group E
Section 305

Six or more persons at any one time for educational purposes through the 12th grade
Reminder: Spaces accessory to Church are A-3

---

Educational Group E
Section 305

Day care for more than 5 children over 2 ½ years old
305.2.1 A-3 - within places of religious worship.
305.2.2 Same as main occupancy for 5 or fewer children
305.2.3 R-3 - Five or fewer children in Dwelling Unit

---

Factory-Industrial Group F
Section 306

Two groups,
- F-1 MODERATE HAZARD
- F-2 LOW HAZARD

Not classified as a GROUP H
### F-1 Moderate Hazard

**Section 306.2**

Factory-Industrial uses that are not classified as F2 Low Hazard. This includes aircraft, automobiles, carpet and rugs, dry cleaning, food processing, and woodworking.

### Group F-1 Occupancy

**306.2** - Food processing establishments and commercial kitchens. Not associated with a restaurant, or similar dining facility.

**More than 2,500 sq. ft. in area.**

### F-2 Low Hazard Section 306.3

Fabrication or manufacturing of NON-COMBUSTIBLE materials.

No significant fire hazard.

- Finishing, packing, or processing of materials including:
  - nonalcoholic beverages
  - glass products
  - brick and masonry
Use of a building or portion
Manufacturing, processing,
generation or storage
Involving materials that present a
physical or health hazard
**Triggered by excessive quantities**

---

**High-Hazard Group H**

[F] Section 307

The following shall not be classified in Group H, but
shall be classified in the occupancy that they most nearly resemble:

1. Buildings and structures occupied for the application of
flammable finishes, provided that such buildings or areas
conform to the requirements of Section 416 and the *Fire Code*.
2. Wholesale and retail sales and storage of flammable and
combustible liquids in mercantile occupancies conforming
to the *Fire Code*.
**High-Hazard Group H**

Uses other than Group H

3. Closed piping system containing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.

4. Cleaning establishments that utilize combustible liquid solvents having a flash point of 140°F (60°C) or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire barriers constructed in accordance with Section 707 or 1-hour horizontal assemblies constructed in accordance with Section 711, or both.

5. Cleaning establishments that utilize a liquid solvent having a flash point at or above 200°F (93°C).


**Group H Categories**

*Sections 307.3 to 307.7*

- H-1 Detonation hazard
- H-2 Deflagration hazard
- H-3 Readily support combustion
- H-4 Health hazards
- H-5 Semiconductor fabrication facilities
High-hazard Group H-5

[F] 307.7 High-hazard Group H-5. Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 307.1(1) and 307.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.11.

Group H Quantities

• “Normal” occupancy limited to quantities per CONTROL AREA
  – Portion of a building separated by 1 hour construction
• Table 307.1(1) and (2)
  – Specifies the allowed quantity factors
  – IF any quantity is exceeded ...
  • Column 3 specifies the appropriate H category

<table>
<thead>
<tr>
<th>Material</th>
<th>Class</th>
<th>Group if Quantity Exceeded</th>
<th>Storage Solid pound (cubic ft.)</th>
<th>Liquid gallons (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible Fiber</td>
<td></td>
<td>H-3</td>
<td>(100)</td>
<td>N/A</td>
</tr>
<tr>
<td>Loose Baled</td>
<td></td>
<td>H-3</td>
<td>(1,000)</td>
<td>N/A</td>
</tr>
<tr>
<td>Flammable Liquid</td>
<td>IA and IC</td>
<td>H-2 or H-3</td>
<td>N/A</td>
<td>20** or 120** **</td>
</tr>
</tbody>
</table>

Sample from Table 307.1(1)
Institutional Group I
Section 308

4 Groups based on Characteristics of Exiting
- People with Physical Limitations
  - Health or Age
  - Ambulatory and Non-ambulatory
- Harbored (domiciled)
  - Treatment or Care
  - Detained

Institutional Group I-1
Section 308.2
- SUPERVISED CUSTODIAL CARE
  - More than 16 persons
  - 24 hour basis
- Such as …
  - Assisted living facilities, group homes, alcohol and drug centers

Group I-1 Occupancy

- Two Conditions:
  - Section 308.2.1. Condition 1
    - Receiving custodial care
    - Capable of responding to an emergency
Group I-1 Occupancy

Two Conditions:

Section 308.2.2. Condition 2
   Receiving custodial care
   Require limited verbal or physical assistance in responding to an emergency

Institutional Groups I-1

- Section 308.2.3 - I-1 Institutional Occupancy
  - With 6 to 16 people –
    • Treated like a residence R-4
- Section 308.2.4 - I-1 Institutional Occupancy
  - With 5 or less people –
    • Treated like a residence R-3; OR
    • Comply with the International Residential Code.

Institutional Group I-2

Section 308.3

• HOSPITALS, NURSING HOMES AND
• FOSTER CARE FACILITIES
  More than 5, Incapable of self preservation
  24 hour basis
### Group I-2 Occupancy

#### Two conditions

- **Section 308.3.1.1 Condition 1**
  - Provide nursing or medical care
  - Does NOT provide emergency care, surgery, obstetrics or inpatient stabilization units.

#### Section 308.3.1.2 Condition 2

- Provide nursing or medical care
- Can provide emergency care, surgery, obstetrics or inpatient stabilization units.
- Including but not limited to hospitals.

### Institutional Group I-2 Section 202

**Definitions related to I-2 Occupancies:**

- **INCAPABLE OF SELF-PRESERVATION.** Persons because of age, physical limitations, mental limitations, chemical dependency, or medical treatment who cannot respond as an individual to an emergency situation.

- **MEDICAL CARE.** Care involving medical or surgical procedures, nursing or for psychiatric purposes.

- **FOSTER CARE FACILITIES.** Facilities that provide care to more than five children, 2 1/2 years of age or less.
**Institutional Groups I-2**

*Section 308.3.2*

**I-2 Occupancy**

- With 5 or less people –
  - Classified as an R-3 residence; **OR**
  - Comply with the International Residential Code.
    - Requires a sprinkler system

**Institutional Group I-3**

*Section 308.4*

**DETENTION FACILITIES**

More than 5 people

- Under restraint or security

5 conditions

- Free movement to exit
- Free movement to smoke compartment
- Movement confined to smoke compartment
- Remote control release from space
- Staff controlled release from space

**Institutional Group I-4**

*Section 308.5*

**DAY CARE FACILITIES**

- Persons of any age
- Custodial care for less than 24 hours
- More than 5 occupants

Adult Care Facility
Child Care Facility
Institutional Group I-4
Section 308.5.1

Group E Occupancies if:
- Custodial care for less than 24 hours
- 5 to 100 occupants 2 ½ years of age and under
- Located on first floor
- Exit door goes directly to the exterior

Institutional Group I-4
Section 202

Definition related to I-4 Occupancies:
CUSTODIAL CARE. Assistance with day to day living tasks: such as cooking, taking medication, bathing, using toilet facilities and other tasks of daily living. Custodial care includes persons who have the ability to respond to emergency situations and evacuate at a slower rate and/or who have mental and psychiatric complications.

Institutional Group I-4
Section 308.5

Not classified as I-4 Occupancies
- Within Places of Worship – providing care during religious functions - same as primary occupancy
- 5 or fewer occupants – receiving custodial care - then same as primary occupancy
- 5 or fewer occupants – receiving custodial care in a Dwelling Unit – R-3 Occupancy or NYSRC
**Mercantile Group M Section 309**

Display and sale of merchandise  
Stocks of goods, wares or merchandise  
Department stores, markets, retail and wholesale,  
and motor fuel-dispensing facilities

**Residential Group R Section 310**

R-1 Transient Residential  
- Hotels, motels  
R-2 Permanent Residential  
- More than 2 dwelling units (Apartments)  
- Congregate (nontransient) > 16 occupants  
R-3 One and Two Family  
- Not R-1, R-2, R-4 or I  
- Not more than two dwelling units  
- Congregate living facilities with limited occupants  
R-4 Residential Care, Assisted Living

**Section 202**

Definitions:  
- Transient: Occupancy of a dwelling unit or sleeping unit for not more than 30 days.
Group R-3 Occupancy

Section 310.4.2 Lodging Houses:
Owner occupied lodging houses with five or fewer guest rooms and 10 or fewer total occupants shall be permitted to be constructed in accordance with the 2020 RCNYS

Section 202

Definitions:

- **Lodging House** – A one-family dwelling where one or more occupants are primarily permanent in nature and rent is paid for guest rooms.
- **Guestroom** – A room used by one or more guest for living or sleeping purposes.

Group R-4 Occupancy

Split into two conditions

Section 310.5.1 Condition 1
- Receiving custodial care
- Capable of responding to an emergency
Group R-4 Occupancy

Section 310.5.2. Condition 2
- Receiving custodial care
- Require limited verbal or physical assistance in responding to an emergency

Storage Group S
Section 311
S1 Moderate Hazard
- Combustible contents

S2 Low Hazard
- Non-combustible goods
Not classified as Hazardous Occupancy

Storage Occupancies, not classified as Group H

311.1.1 Accessory Storage Spaces
- Considered same as the occupancy they are accessory to.
Utility and Miscellaneous Group U
Section 312

Buildings and Structures of an accessory character
Typically not occupied
Don’t fit into other categories

September 23, 2020

Utility and Miscellaneous Group U
Section 312.1.1

Greenhouses that are not classified as another occupancy shall be classified as Group U

September 23, 2020

Occupancy Classification Exercise
Student Exercise
Appendix Pg. 2 & 3
What is the Occupancy?

Start with Section 302.1

- Cell phone tower
- Hotel (transient)
- Movie theater
- Elementary school
- Psychiatric hospital
- College basketball arena
- Building depart. offices

What is the Occupancy?

- Clothing store
- Explosives (division 1.1) manufacturing plant
- Café seating 65 people
- Infant day care center with 15 children
- Masonry block manufacturing plant

Motor Vehicle Related Occupancies

- Public parking garage
- Automobile showroom
- Repair garage
- Car factory
- Motor fuel dispensing station
Conclusion: Occupancy Classification

- Based on Similar Characteristics
- To Achieve Equivalent Safety
- Occupant Related Hazards
- Content Related Hazards
Lesson 2
Types of Construction

Chapter 6
Types of Construction

Fire Safe Design
Factors and Building Materials

Combustible vs Noncombustible
Protected or Unprotected
Definitions

Fire Resistance
That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases, or flames under conditions of use.

Fire Resistance Ratings
- The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both as determined by the tests, or the methods based on tests, prescribed in §703.

Primary Goals of Chapter 6
- Maintain STRUCTURAL STABILITY under Fire Conditions
  - Collapse helps no one!
- Reduce the threat to ADJACENT BUILDINGS
  - Let's not make things worse than they are.
Construction Classification

Section 602

• 602.2 Types I and II: Noncombustible Elements
• 602.3 and 602.4 Types III and IV:
  – Exterior elements noncombustible
  – Interior elements combustible
• 602.5 Type V: Any material permitted by the code
  – Traditionally combustible

Section 602.2 Types I and II

“Construction in which the building elements listed in Table 601 are of noncombustible materials.”

• Type I could be called “Fire Resistant”
• Type II is simply “Noncombustible”

Type I
Noncombustible with Fire resistance

• Cast-in-Place Concrete
Type I
Noncombustible with Fire resistance

Concrete Encasement

Type I
Noncombustible with Fire resistance

Spray On
Fire resistance

Type II
Non-Combustible Materials

Unprotected Steel
Type II
Non-Combustible Materials

• Steel Loses Strength in a Fire

Type II
Non-Combustible Materials

• Steel Elongates - Steel is Thermoplastic

Type III

• Exterior walls must be non-combustible
• Interior elements may be of any material permitted by this code
• Fire retardant-treated wood shall be permitted within exterior walls of 2 hour rating or less
Type III

- Exterior Walls are Non-Combustible
- Interior may be wood

Type III

- Interior Structural Members

Type IV Heavy Timber

- Exterior walls must be non-combustible
- Interior elements of solid wood, laminated wood, heavy timber or composite lumber without concealed spaces
- Section and Table 2304.11 provides the specific minimum dimensions
- Fire retarded treated wood shall be permitted within exterior walls of 2 hour rating or less
Type IV: Heavy Timber

- Exterior walls are Non-Combustible

Type IV: Heavy Timber

Interior may be wood
Large structural members
No concealed spaces
Plank floor and roof

Type IV: Heavy Timber

Exterior walls are Non-Combustible
Interior may be wood
After a renovation
Type IV: Heavy Timber

<table>
<thead>
<tr>
<th>Table 2304.11 Type IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
</tr>
<tr>
<td>Floor load with an exposed floor and roof load</td>
</tr>
<tr>
<td>Snow loads with an exposed floor and roof load</td>
</tr>
<tr>
<td>Wind loads and pressure</td>
</tr>
<tr>
<td>Roof load only</td>
</tr>
</tbody>
</table>

Type IV Heavy Timber? NO
Type V

“... construction in which the structural elements, exterior walls and interior walls are of any materials permitted by this code.”
### Table 601 (Translation of)
Construction Types vs. Combustibility

<table>
<thead>
<tr>
<th>Element</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit. Walls</td>
<td>NC</td>
<td>NC</td>
<td>NC (FRTW Permitted)</td>
<td>Comb. (Any Mat’ls.)</td>
<td>Comb. (Any Mat’ls.)</td>
</tr>
<tr>
<td>Int. Walls</td>
<td>NC</td>
<td>NC</td>
<td>Comb. (Any Mat’ls.)</td>
<td>Comb. H1</td>
<td>Comb. (Any Mat’ls.)</td>
</tr>
<tr>
<td>Columns</td>
<td>NC</td>
<td>NC</td>
<td>Comb. (Any Mat’ls.)</td>
<td>Comb. H1</td>
<td>Comb. (Any Mat’ls.)</td>
</tr>
<tr>
<td>Floor Framing</td>
<td>NC</td>
<td>NC</td>
<td>Comb. (Any Mat’ls.)</td>
<td>Comb. H1T</td>
<td>Comb. (Any Mat’ls.)</td>
</tr>
<tr>
<td>Roof Framing</td>
<td>NC</td>
<td>NC</td>
<td>Comb. (Any Mat’ls.)</td>
<td>Comb. H1</td>
<td>Comb. (Any Mat’ls.)</td>
</tr>
</tbody>
</table>

### Table 601
Fire-resistance Rating requirements for Building Elements (Hours)

<table>
<thead>
<tr>
<th>Building Element</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masonry structural floors (see Section 301)</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Masonry walls</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Masonry elements</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Wood framing and partitions</td>
<td>See Table 602</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brick framing and partitions</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Squared timbers and partitions</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Floor construction and associated secondary masonry (see Section 301)</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Roof construction and associated secondary masonry (see Section 301)</td>
<td>1½</td>
<td>1½</td>
<td>1½</td>
<td>1½</td>
<td>0</td>
</tr>
</tbody>
</table>
Methods for Fire Resistance

Material is INHERENTLY Fire Resistive

Protection is DIRECTLY APPLIED

Protection by MEMBRANE
Type of Construction Exercise

Student Exercises

Appendix Pg. 4 & 5

This building is proposed to be
Type II-B, Non-combustible

• Your Job is to verify it using Table 601
• The plans say:

We will do this one together

Roof: __ hour rating

Exterior bearing walls: __ hour rating

Floor/ceiling: __ hour rating

Structural frame: __ hour rating

Does this building satisfy Type III-A Construction requirements?

Non-combustible Roof: 1 hour

Non-combustible exterior bearing walls, 2 hours

Combustible, non-load bearing partition, nonrated

Wood framed floor/ceiling, 1 hour

Structural frame or interior bearing walls, 1 hour

1 hour

1 hour
Does this building satisfy Type IV Construction requirements?

Non-combustible exterior bearing walls, 1 hour or 2 hour rating required
Non-bearing partition, solid wood
Floor/ceiling heavy timber

This building is proposed to be Type I-A, Non-combustible.

Roof: 1.5 hour rating
Exterior bearing walls: 3 hour rating
Floor/ceiling: 2 hour rating
Non-bearing partition: 0 hour rating

Quiz: What Construction Type?

Unprotected Steel Girder
Ceiling/Roof is Wood
Brick Exterior
III-B
Construction Types

- 5 General Classifications
  - Based on Combustibility and Fire Resistance
- Sub-classified
  - “A” provides more fire resistance than “B”
- Table 601 regulates Building Elements
- Table 602 ALSO regulates Exterior Walls (Future lesson)
Lesson 3
General Building Heights And Areas

Chapter 5
General Building Heights And Areas

September 23, 2020

Allowable Building Size

• The Basic Concept
  Occupancy and Construction
  Frontage and Sprinklers
• Details
  Language and Definitions
  Use of the Tables
  Calculations for Increases
This Lesson will focus on a Single Occupancy Building
   – Learn the basic methodology

• A Future Lesson will deal with Mixed and Accessory Use buildings
• The terms and application will only confuse the issue at this time

Area within surrounding Exterior Walls
   – or exterior walls and FIRE WALLS
   – exclusive of vent shafts and courts
Area, Building (Includes) Definitions: Section 202

Areas NOT within Surrounding Walls
- shall be included IF within the horizontal projection of the floor or roof above

FIRE WALL ... rated wall having protected openings ... continuous from foundation to or through the roof ... sufficient structural stability ... to allow collapse ...

A FIRE WALL creates separate BUILDINGS

Table 504.3 Allowable Building Height in Feet Above Grade Plane (Page 102)
Sprinkler Systems

Section 903.3.1.1 NFPA 13 Sprinkler System –
Commercial Type Systems designed based on hazards

Section 903.3.1.2 NFPA 13R Sprinkler System
Residential type systems – for R Occupancies
Limited to buildings up to 4 stories in height

Section 903.3.1.3 NFPA 13D Sprinkler System
One- and two-family dwellings, Townhouses R-4 Occupancies - Condition 1

GRADE PLANE. A reference plane representing the
average finished ground level adjoining the building at exterior walls.
Includes details for ground that slopes away from the exterior walls.

HEIGHT, BUILDING ...The vertical distance from the grade plane to the average height of the highest roof surface.

Flat roof is easy! It is what it is
Pitched roof is \( \frac{1}{2} \) the distance between the soffit and the ridge
STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above (also see "Basement," "Building height," "Grade plane" and "Mezzanine"). A story is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

STORY ABOVE GRADE PLANE. Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is:

1. More than 6 feet (1829 mm) above grade plane;
2. More than 12 feet (3658 mm) above the finished ground level at any point.
**Basement**

Section 202

**BASEMENT.** A story that is not a story above grade plane (see "Story above grade plane"). This definition of "Basement" does not apply to the provisions of Section 1612 for flood loads.

---

**Example: Not a Story Above Grade Plane**

This is a 1 story building.

The finished surface of the 1st floor does not meet any of the "basement exceptions" in the Code.

The basement is NOT recognized as a story above grade plane.
Example: Is A Story Above Grade Plane

This is a 3 story building. The finished surface of the 1st floor is over 6 feet above grade and meets one of the "basement exceptions" in the Code. It is recognized as a story above grade plane.

Example: Is A Story Above Grade Plane

This is a 3 story building. Floor next above is more than 12' above the ground level at any point.

Table 504.4: Allowable Number of Stories Above Grade Plane (page 103-104)
A Division of New York
Department of State

Example: Building Stories

Using Table 504.4 (page 103)
A-1 occupancy of Type IB construction:
Non-sprinklered?
5 stories max in non-sprinklered

Fully Sprinklered?
6 stories max in Sprinklered

Table 504.4: Allowable number of stories above grade plane

<table>
<thead>
<tr>
<th>OCCUPANCY CLASSIFICATION</th>
<th>TYPE OF CONSTRUCTION</th>
<th>OTHER DETAILS</th>
<th>HEIGHT IN FEET</th>
<th>HEIGHT IN STORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>A-2</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>A-3</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>A-4</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>A-5</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>B</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>D</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>E</td>
<td>Type IB</td>
<td>Fully Sprinklered</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

Building Story, and Height Exercise
Using Tables 504.3, and 504.4

<table>
<thead>
<tr>
<th>Occupancy Group</th>
<th>Type of Construction</th>
<th>Other details</th>
<th>Height in Feet</th>
<th>Height in Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department store</td>
<td>Non-combustible elements, no additional fire resistance</td>
<td>Sprinklered</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Sleepy Time Motel</td>
<td>Masonry exterior walls, 2 hour rated, and unrated wood frame interior</td>
<td>Non-sprinklered</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Bob's Bar and Grill</td>
<td>Log Cabin</td>
<td>Sprinklered</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Veterinary Hospital</td>
<td>Wood frame, no fire resistance rating</td>
<td>Non-Sprinklered</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>
Remember we plan to keep it simple. Only Single Occupancy/Use buildings in this lesson.
Allowable Area Determination
Section 506.2

Section 506.2.1 - One Occupancy and One story Buildings

\[ A_a = A_t + (NS \times I_f) \] Formula

- \( A_a \) = Allowable area (square feet)
- \( A_t \) = Tabular allowable area from Table 506.2
- \( NS \) = Tabular area factor for Non-sprinklered building from Table 506.2 (regardless if the building is sprinklered)
- \( I_f \) = area factor increase based on Section 506.3

Example:
A-2 occupancy of One story Type III-B construction – Fully sprinklered. No frontage increase.

Table 506.2: Allowable area factor in Square Feet (pages 107-108)
### Allowable Area Determination  
**Section 506.2**

- **Example:** A-2 occupancy of One story  
  - **Type III-B construction** – sprinklered.  
  - **No frontage increase.**  
    - \( A_s = A_t + (NS \times I_f) \) \text{ Equation 5-1}  
    - \( A_s = 38,000 + (9,500 \times 0) \)  
    - \( A_s = 38,000 + 0 \)  
    - \( A_s = 38,000 \)  

*This formula is not necessary for a single occupancy single story building unless a frontage increase is taken. (Zero times anything is Zero)*

### Allowable Area Determination  
**Section 506.2**

- **Section 506.2.1** - One Occupancy, One story Buildings  
- **Section 506.2.3** - One Occupancy, Multi story Buildings

### Allowable Area Determination  
**Section 506.2**

- **Example:** M occupancy, Fully Sprinklered, 4 story Type IIB construction. No frontage increase taken  
  - \( A_s = [A_t + (NS \times I_f)] \times S_a \quad \text{(Equation 5-2)} \)  
  - We go to table 506.2 for the \( A_t \) and \( NS \) numbers
Equation 5-2

- \( A_a = (A_t + (NS \times I_f)) \times S_a \)
- \( A_a = \) Allowable area (square feet)
- \( A_t = \) Tabular allowable area factor (NS, S13R or SM value, as applicable) in accordance with Table 506.2
- \( NS = \) Tabular allowable area factor in accordance with Table 506.2 for non-sprinklered building (regardless of whether the building is sprinklered).
- \( I_f = \) Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3
- \( S_a = \) Actual number of building stories above grade plane, not to exceed three.
- For buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2 (NFPA 13R) use the actual number of building stories above grade above grade plane, not to exceed four.

### Table 506.2:

**Allowable area factor in Square Feet**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>NF LEVEL</th>
<th>TYPE</th>
<th>TYPE II</th>
<th>TYPE III</th>
<th>TYPE IV</th>
<th>TYPE V</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-1</td>
<td>L/L</td>
<td>500</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
</tr>
<tr>
<td>M-1</td>
<td>L/L</td>
<td>500</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
</tr>
<tr>
<td>B-1</td>
<td>L/L</td>
<td>500</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
</tr>
<tr>
<td>S-1</td>
<td>L/L</td>
<td>500</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
</tr>
<tr>
<td>S-2</td>
<td>L/L</td>
<td>500</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
</tr>
</tbody>
</table>
Allowable Area Determination

- Section 506.2.3 - One Occupancy and Multi story Buildings
- Example: M occupancy, Fully Sprinklered, 4 story Type IIB construction.
- \[ A_a = \left[ A_t + (NS \times I_0) \right] \times S_a \] (Equation 5-2)
- \[ A_a = [37,500 + (12,500 \times I_f)] \times S_a \] (Section 506.2.3)

Allowable Area Determination

- Section 506.2.3 - One Occupancy and Multi story Buildings
- Example: M occupancy, Fully Sprinklered, 4 story Type IIB construction. No frontage increase.
- \( S_a = \) actual number of building stories above grade plane, not to exceed 3.

Allowable Area Determination

Section 506.2.3 - One Occupancy and Multi story Buildings
- Example: M occupancy, Fully Sprinklered, 4 story Type IIB construction. No frontage increase.
- \( S_a = \) actual number of building stories above grade plane, not to exceed 3.
- \[ A_a = [37,500 + (12,500 \times 0)] \times 3 \] (Max 37,500 per story)
- \[ A_a = 112,500 \] (total cumulative square footage allowed)
Section 506.2.3 - One Occupancy and Multi-story Buildings

- $S_a$ = actual number of building stories above grade plane, not to exceed 3.
- $A_a = [37,500 + (12,500 \times 0)] \times 3$
- $A_a = 112,500$ (total cumulative square footage allowed)

Occupancies with an NFPA 13R sprinkler system can have 4 stories but cannot exceed 37,500 per story or total of 4 x $A_a$. 

Section 506.2.3 - One Occupancy and Multi-story Buildings

- $S_a$ = actual number of building stories above grade plane, not to exceed 3.
- $A_a = [37,500 + (12,500 \times 0)] \times 3$
- $A_a = 112,500$ (total cumulative square footage allowed)

Can have 4 stories but cannot exceed 37,500 per a story or total of 3 x $A_a$. 

Section 506.2.3 - One Occupancy and Multi-story Buildings

- $S_a$ = actual number of building stories above grade plane, not to exceed 3.
- $A_a = [37,500 + (12,500 \times 0)] \times 4$
- $A_a = 150,000$ (total cumulative square footage allowed)

R Occupancies with an NFPA 13R sprinkler system can have 4 stories but cannot exceed 37,500 per a story or total of 4 x $A_a$. 

- $A_a = 37,500$
- $A_a = 37,500$
- $A_a = 37,500$
- $A_a = 37,500$
### Building Area Exercise

**Using Tables 506.2**

<table>
<thead>
<tr>
<th>Occupancy Group</th>
<th>Type of Construction</th>
<th>Other Details</th>
<th>Tabular Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department Store</td>
<td>Non-combustible elements, no additional fire resistance</td>
<td>Sprinklered</td>
<td>2 story</td>
</tr>
<tr>
<td>Sleepy Motel – Transient</td>
<td>Masonry exterior walls, 2 hour rated, and unrated wood frame interior</td>
<td>Non-Sprinklered</td>
<td>1 story</td>
</tr>
<tr>
<td>Bob’s Bar and Grill</td>
<td>Log Cabin</td>
<td>Sprinklered</td>
<td>2 story</td>
</tr>
<tr>
<td>Veterinary Hospital</td>
<td>Wood frame, no fire resistance rating</td>
<td>Non-Sprinklered</td>
<td>3 story</td>
</tr>
</tbody>
</table>

### 506.3 Frontage Increase

**Details for yards and open space**

- Building must adjoin or have access to a public way
- Increase allowed is proportional to perimeter
- **FRONTAGE OPEN SPACE**
- Tabular Values “assume” 25%
- OPEN SPACE must be a minimum of 20’ wide, and maximum credit for 30’ wide.

### Terminology

**PUBLIC WAY.** A street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and which has a clear width and height of not less than 10 feet (3048 mm).

**YARD.** An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this code, on the lot on which a building is situated.
Frontage Increase

Open areas can be utilized by the fire service to gain access to the perimeter of the building.

Frontage

Equation 5-4, \( W = (L_1 \times W_1 + L_2 \times W_2 + L_3 \times W_3 \ldots) \)

Equation 5-5, \( I_f = \frac{[F/P - 0.25]}{W/30} \)

Equation 5-1, \( A_a = A_t + (NS \times I_f) \)

Equation 5-2, \( A_a = A_t + (NS \times I_f) \times S_a \)

Equation 5-3, \( A_a = [A_t + (NS \times I_f)] \)

5-4 & 5-5 Equation Variables

Perimeter = \( P \)

\( P = L_1 + L_2 + L_3 + L_4 \)

\( P = 100+100+100+100 \)

\( P = 400 \)
5-4 & 5-5 Equation Variables

Width of public way = W
W = 20'

5-4 & 5-5 Equation Variables

Width of public way = W
W1 = 30'
W2 = 20'
W3 = 30'
W4 = 24'

5-4 & 5-5 Equation Variables

Frontage = F
F = L1 + L2 + L3 + L4 (yard > 20')
F = 100 + 100 + 100 + 100
F = 400
5-4 & 5-5 Equation Variables

Frontage = F
F = L1 + L3 + L4 (yard > 20')
F = 100 + 100 + 100 + 100
F = 300

Equation 5-4 Weighted Average Formula

\[ W = \frac{(L1 \times W1 + L2 \times W2 + L3 \times W3 + L4 \times W4)}{F} \]

W = (100 \times 20 + 100 \times 20 + 100 \times 20 + 100 \times 20) / 400
W = 8000 / 400
W = 20

Equation 5-5 Formula for Frontage Determination

\[ I_f = \frac{[F/P - 0.25]}{W/30}. \]
\[ I_f = \frac{[400/400 - 0.25]}{20/30} \]
\[ I_f = .75 \times .67 \]
\[ I_f = .50 \]
Example 1

73,800 sq. ft. single-story office building (B Occupancy), type V-a construction that is fully sprinklered.

\[ W = \frac{(L_1 \times W_1 + L_2 \times W_2 + L_4 \times W_4)}{F} \]

\[ W = \frac{(225 \times 30 + 328 \times 20 + 328 \times 20)}{225 + 328 + 328} \]

\[ W = \frac{19,780}{881} \]

\[ W = 22.5 \]

Side 3 is not included.

Example 1

\[ I_f = \frac{[F/P - 0.25] \times W}{30} \]

\[ I_f = \frac{[881/1106 - 0.25] \times 22.5}{30} \]

\[ I_f = \frac{.80 - 0.25}{.75} \]

\[ I_f = .41 \]
Example 1

Equation 5-1 single-occupancy, one story
\[ A_a = A_t + (NS \times I_f) \]

Equation 5-2 mixed-occupancy, one story
\[ A_a = A_t + (NS \times I_f) \times S_1 \]

Equation 5-3 mixed occupancy, multistory
\[ A_a = [A_t + (NS \times I_f)] \]

---

Example 1

5-1, 5-2, & 5-3 Equation Variables

\[ A_a = \text{Allowable area.} \]

\[ I_f = \text{Area increase due to frontage.} \]

\[ A_t = \text{Tabular allowable area.} \]

\[ S_1 = \text{Sprinklered, one story.} \]

\[ S_M = \text{Sprinklered, multistory.} \]

\[ NS = \text{Non-sprinklered.} \]

---

\[ A_a = 72,000 + (18,000 \times .41) \]

\[ A_a = 79,380 \]

Proposed = 73,800
Allowed = 79,380

Building is compliant
Student Exercises
Appendix Pages 7 - 10

Exercise 1:
M Occupancy of Type IIIB construction
Three stories - Fully Sprinklered

\[ A_a = A_t + (NS \times I_f) \]
\[ A_a = 37,500 + (18,500 \times I_f) \]

Is this correct?
Verify these 2 numbers

Exercise 2:
B Occupancy of Type VB construction
Four stories - Fully Sprinklered

\[ A_a = A_t + (NS \times I_f) \]
\[ A_a = 27,500 + (9,000 \times I_f) \]

Is this correct?
Verify these 2 numbers
Exercise 3:
R-2 Occupancy of Type VB construction
two stories - NFPA 13-R Sprinkler

\[ A_a = A_t + (NS \times I_f) \]
\[ A_a = 7,000 + (7,000 \times I_f) \]

Is this correct? Verify these 2 numbers

Exercise 4:
E Occupancy of Type II B construction
One story - partially Sprinklered

\[ A_a = A_t + (NS \times I_f) \]
\[ A_a = 58,000 + (14,500 \times I_f) \]

Is this correct? Verify these 2 numbers

Exercise 5:

\[ I_f = \left( \frac{F}{P} - 0.25 \right) \times \frac{W}{30} \]
\[ I_f = 395 - 0.25 \times \frac{W}{480} \]

\[ F = 310 \quad L_1 = 460 \]

Does this verify? NO! 310 (L1+L2+L3) 460 (P)

\[ L_2 \]
\[ L_3 \]


doesnotverifypicture
Exercise 6:

\[ W = \frac{(L_1 \times W_1) + (L_2 \times W_2) + (L_3 \times W_3)}{80 + 150 + 80} \]

\[ W = \frac{(80 \times 30) + (150 \times 30) + (80 \times 30)}{310} \]

Is this correct?

SUMMARY

Chapter 5 (so far…)

Building Area, Building Height and Stories
Using Tables and formulas

Increases based on:
Sprinklers – height and area
Frontage - Area
Lesson 4
Special Detailed Requirements
and How to Treat Mixed Uses

Chapter 4
Special Detailed Requirements based on Use and Occupancy

- Covered Mall
- High Rise
- Atriums
- Underground
- Vehicle related
- I-2 Medical
- I-3 Detention
- Projection Rooms
- Stages and Platforms
- Special Amusement
- Aircraft related
- Combustible Storage
- Hazardous Materials
- Group H Occupancies
- Flammable Finishes
- Drying Rooms
- Organic Coatings
- Group I-1, R-1, R-2, R-3, and R-4
- Hydrogen Cutoff Rooms
Covered Mall

- **Definition:**
  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 where in two or more tenants have a main entrance into one or more malls.

Mall Definitions

- Under the definition of a Covered Mall Building we also have:
  - Mall
  - Open Mall
  - Open Mall Building

Covered Mall Buildings

- **Section 402**
  - Applies to buildings and structures defined as covered or open mall buildings
  - **Exceptions:**
    - Anchor Stores (in definition)
    - Foyers and Lobbies in B, R-1, and R-2
    - If building totally complies with other provisions
Covered Mall Buildings

- 402.2 Open Space
  - Section 402.2 – requires permanent open space of 60 feet on all sides.
  - Exception allows reduction to 40 feet

Covered Mall Buildings

- 402.4 Construction
  - 402.4.1 thru 402.4.3
  - 402.4.1 Area and Types of construction
    - Unlimited area if Limited to 3 floor levels at any point or 3 stories above grade plane AND
    - Type I, II, III or IV construction

Covered Mall Buildings

- 402.4 Construction
  - 402.4.2 Fire-Resistance-Rated Separation
    - Required between Tenant Spaces but not Mall space
      - Fire Partitions
    - Required between Mall and Anchor store (with exceptions)
      - Fire Wall
      - If Type IA, IB, IIA or IIB Construction opening protection is not required.
Covered Mall Buildings

- **402.4 Construction**
  - **402.4.3 Open Mall Construction**
    - Floor assemblies and open roof assemblies
    - Pedestrian Walkways

---

**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.

---

- **402.8.2 Determination of Occupant Load**
  - Based on gross leasable area (excluding Anchor stores 402.1.2)
  - Equation 4-1: \( OLF = (0.00007) \times (GLA) + 25 \)
    - \( OLF \) = The occupant load factor (sq. ft. per person)
    - \( GLA \) = Gross Leasable Area (sq. ft.)
  - Example: \( OLF = (0.00007) \times (400,000) + 25 \)
    - \( OLF = 53 \) square feet per person
    - \( 400,000 \div 50 = 8,000 \) people
Covered Mall Buildings

- 402.8.2.4 Food courts
  - Occupant load based on Section 1004
  - Added to Occupant load of Mall

Covered Mall Buildings

- 402.8.5 Distance to Exits
  - Maximum 200 feet
    - From tenant spaces
    - From any point in mall

Chapter 4

- Covered Mall
- High Rise
- Atriums
- Underground
- Vehicle related
- I-2 Medical
- I-3 Detention
- Projection Rooms
- Stages and Platforms
- Special Amusement
- Aircraft related
- Combustible Storage
- Hazardous Materials
- Group H Occupancies
- Flammable Finishes
- Drying Rooms
- Organic Coatings
- Group I-1, R-1, R-2, R-3, and R-4
- Hydrogen Cutoff Rooms
High Rise Building

Definition:
A building with an occupied floor located more than 75 feet (22860 mm) above the lowest level of fire department vehicle access.

High Rise Buildings

Section 403

• Exempt Buildings:
  – Airport Traffic Control Towers – Section 412.2
  – Opening Parking Garages – Section 406.5
  – Portion that has an A-5 occupancy – Section 303.6
  – Special Industrial Occupancies – Section 503.1.1
  – Buildings with H-1, H-2 – sections 415.8, 415.9.2 & 3 or 426.1, or H-3 - Section 415.8

• 403.2 Construction
  – Section 403.2.1 - Reductions allowed in Fire Resistance rating only if:
    • Have supervisory Initiating devices for Sprinkler Control Valves
    • Water-flow Initiating Devices on each floor
High Rise Buildings

403.2 Construction
Section 403.2.1.1 Reductions in Fire Resistance Ratings
Type IA reduced to IB if building not over 420 ft.

In other than F-1, H-2, H-3, H-5, M and S-1
-Type IB reduced to IIA.

403.2 Construction
Section 403.2.1.2 – Reduction for Shaft Enclosure Fire Resistance
Ratings only in
Buildings under 420 feet
Must have automatic sprinklers
In the Shaft at top; and
On Alternate Floors

Section 403.2.3 Structural Integrity
Interior Exit Stairways and Elevator Hoist way Enclosures
Risk Category III and IV Buildings – Section 1604.5
Applies to Buildings over 420 feet
Addresses Wall Assembly and Materials
High Rise Buildings
Section 403.3 - Automatic Sprinklers System
Section 403.3.1
Sprinkler Risers in Buildings over 420 feet in Height
Minimum of 2 Risers per zone
Located in Interior Exit Stairways and Ramps

Section 403.3.3 Secondary Water Supply
When in Seismic Design Category C,D,E, or F.

High Rise Buildings
Section 403.4 Emergency Systems
– Section 403.4.1 through 403.4.8
  • 403.4.1 Smoke Detection
  • 403.4.2 Fire Alarm
  • 403.4.3 Standpipe System
  • 403.4.4 Emergency Voice/Alarm Communications
  • 403.4.5 Emergency Responder Radio Coverage
  • 403.4.6 Fire Command
  • 403.4.7 Smoke Removal
  • 403.4.8 Standby and Emergency Power

High Rise Buildings
• Section 403.5 Means of Egress and Evacuation
  – Remoteness of Interior Exit Stairways
    • Minimum of 30 feet or ¼ the diagonal building dimension.
  – Additional Interior Exit Stairways –
    • All but R-2 occupancies over 420 feet high
  – Stairway Door Operation –
    • locked from stairway side if capable of unlocking from command center
  – Smoke proof Enclosures –
    • required on floors over 75 feet.
High Rise Buildings

Section 403.5 Means of Egress and Evacuation

Luminous Egress Path Markings –
In accordance with Section 1025

Emergency Escape and Rescue –
Openings not required

Luminous Egress Path Markings

Section 1025 - Marking of
Steps, Landings, Handrails
Demarcation of perimeter
Floor, Wall and Transitions
Obstacle Marking
Doors within the Exit Path

Luminous Egress Path Markings
High Rise Buildings

Section 403.6 Elevators
- Comply with Chapter 30, and
  - Section 403.6.1 Fire Service Access Elevator –
    - In buildings with occupied floor over 120 feet above LLFA
    - Minimum of two or all (which ever is less)
    - Capacity of not less than 3,500 lbs
  - Section 403.6.2 Occupant Evacuation Elevators –
    - Can be occupant self operated

Chapter 4

- Covered Mall
- High Rise
- Auditoriums
- Underground
- Vehicle related
- I-2 Medical
- I-3 Detention
- Projection Rooms
- Stages and Platforms
- Special Amusement
- Aircraft related
- Combustible Storage
- Hazardous Materials
- Group H Occupancies
- Flammable Finishes
- Drying Rooms
- Organic Coatings
- Group I-1, R-1, R-2, R-3, and R-4
- Hydrogen Cutoff Rooms
Underground Buildings

Section 405

405.1 - Applies to building spaces with a floor level used for human occupancy more than 30 feet below the finished floor of the level of exit discharge.

405.2 through 405.3 Required

• Must be Built of Type I Construction
  – Regardless of Occupancy

• Automatic Sprinklers required –
  – For Exit Discharge Floor and all levels below

405.4 through 405.7 Required

• Compartmentation is required
  – in floors 60 feet below
  – Minimum of two compartments

• Elevators – each compartment shall have direct access
Underground Buildings

405.6 Fire Alarm if required by:
- Section 907.2.17 Smoke Control system
  - Required by Section 405.5.1
- Section 907.2.18 Deep Underground Buildings
  - Manual Fire Alarm System
  - Lowest level is more than 60 feet below

Chapter 4

- Covered Mall
- High Rise
- Atriums
- Underground
- Vehicle related
- I-2 Medical
- I-3 Detention
- Projection Rooms
- Stages and Platforms
- Special Amusement
- Aircraft related
- Combustible Storage
- Hazardous Materials
- Group H Occupancies
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- Group I-1, R-1, R-2, R-3, and R-4
- Hydrogen Cutoff Rooms

Group H-1 Occupancies

Section 415.7 Special Provisions

- Single use building
- Suitable Roof
- Detached Building –
  - Definition – single story without a basement or crawl space
Groups H-2 and H-3
Section 415.8 Special Provisions

- Where required in Detached Building
  - See section 202
    - Single use building, One story in height and
    - No basement or crawl space
- Containing Water Reactive materials
  - Resistant to water penetration
  - No water piping in room or area;
- except for an approved sprinkler system

Mixed Uses and Occupancy
Chapter 5
General Building Heights and Areas

Section 508 Mixed use occupancies, can be either ...
Accessory uses – Section 508.2
Non-separated - Section 508.3
Separated – Section 508.4

Section 509 Incidental Uses and Table 509
Terminology

• Accessory Use
• Mixed Use
• Incidental use area

THERE ARE NO DEFINITIONS!

Descriptions

• Mixed Occupancies
  Accessory
    • Subsidiary to the Main Use
      Non-separated Occupancies
      Separated Occupancies
  • Incidental use area
    – Ancillary to the main occupancy

Incidental Uses

Section 509
• Incidental Use –
  – Separated and Protected per Table 509 and Classified by the Main Use
Incidental Use
Using Table 509

FIRE BARRIER and/or HORIZONTAL ASSEMBLY to be provided where rating is required

What is a FIRE BARRIER?
A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

Incidental Use
Using Table 509

Where a sprinkler is permitted without Fire Barrier, SMOKE TIGHT construction is required

- Sprinkler only required in the hazard area
- Partitions extend to rated ceiling assembly or deck
- Doors self or automatic closing

Using Table 509

<table>
<thead>
<tr>
<th>ROOM OR AREA</th>
<th>SEPARATION AND/OR PROTECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furnace room where any piece of equipment is over 400,000 Btu per hour input</td>
<td>1 hour or provide automatic sprinkler system</td>
</tr>
<tr>
<td>Areas with boilers where the largest piece of equipment is over 15 psi and 10 horsepower</td>
<td>1 hour or provide automatic sprinkler system</td>
</tr>
<tr>
<td>Refrigerant machinery room</td>
<td>1 hour or provide automatic sprinkler system</td>
</tr>
<tr>
<td>Hydrogen control rooms, not classified as Group H</td>
<td>2 hours in Group B, F, N, S and U occupancies; 2 hours in Group A, E, 2 and R occupancies.</td>
</tr>
<tr>
<td>Incinerator room</td>
<td>2 hours and automatic sprinkler system</td>
</tr>
<tr>
<td>Paint shops, not classified as Group H, located in occupancies other than Group F</td>
<td>2 hours; or 1 hour and provide automatic sprinkler system</td>
</tr>
</tbody>
</table>
Not Incidental?

If it does not appear on the table then what?

**Answer:** Must be a Mixed Use.

Mixed Occupancies are covered in Section 508

---

508 Mixed Occupancies

Section 508.2 Accessory Uses

- Each portion individually classified
- Where there is more than one TYPE of occupancy group ...
  - 508.2 Accessory
  - 508.3 Non-separated... OR
  - 508.4 Separated
508 Mixed Occupancies

SECTION 508 MIXED USE AND OCCUPANCY

Each portion of a building shall be individually classified in accordance with Section 302.1.

Where a building contains more than one type of occupancy group:

• shall comply with Section 508.2, 508.3 or 508.4, or a combination of these sections.

Exceptions:
1. Occupancies separated in accordance with Section 510. (Special Provisions)
2. Where required by Table 415.6.2, areas of Group H-1, H-2 and H-3 occupancies shall be located in a detached building or structure.
3. Uses within live/work units, complying with Section 419, are not considered separate occupancies.

Definition - **Live/Work Units** – A dwelling unit or sleeping unit in which a significant portion of the space includes a nonresidential use that is operated by the tenant.

508 Mixed Use and Occupancy

**Exceptions:**
1. Occupancies separated in accordance with Section 510. (Special Provisions)
2. Where required by Table 415.6.2, areas of Group H-1, H-2 and H-3 occupancies shall be located in a detached building or structure.
3. Uses within live/work units, complying with Section 419, are not considered separate occupancies.

Definition - **Live/Work Units** – A dwelling unit or sleeping unit in which a significant portion of the space includes a nonresidential use that is operated by the tenant.

508.2 Accessory Use

**508.2 Accessory occupancies.** ...ancillary to the main occupancy of the building or portion thereof.

Comply with 508.2.1 through 508.2.4.
508.2 Accessory Use

508.2.1 Occupancy classification.
- Each space individually classified
- Requirements of code apply to each portion based on use of that space

508.2.2 Allowable Height and Stories.
- shall be based on the main occupancy in accordance with Section 504.

508.2.3 Allowable building area
- For buildings with accessory occupancies
  - Area based on requirements for main occupancy
    - Comply with Section 506
508.2 Accessory Use

508.2.3 Area Limitations
For accessory occupancies
- Aggregate area ≤ 10% of the STORY
- not exceed Table 506.2
  • Values for a Non-Sprinklered Building

508.2.4 Separation of occupancies.
No separation is required
- Exceptions:
  • 1. Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies
  • 2. Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units shall be separated

Accessory Use 10% Example
• Total Building area = 22,000 SF (for this floor)
• Offices and sales room (aggregate area) is less than 10% of area of the story – therefore no separation required
  • Warehouse area exceeds 10% of the story
  • Does not qualify as an accessory use
Section 508.3 Non-Separated Uses

508 Mixed Occupancies

Occupancies
- Each occupancy individually classified
- Treat each use separately for most issues
- Apply to the total non-separated occupancy area

- Fire Protection (Chapter 9)

508.3. Nonseparated Occupancies

• Height and Area based on MOST RESTRICTIVE
• No Separation required between Occupancies
  - Except as required for:
    • Group H2, H3, H4 and H5.
    • Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units
Proposed one story Non-Sprinklered building

Our documentation shows two hour rated exterior bearing walls, all other parts of the building are non-rated. There is no wall between the printing equipment and the warehouse.

Where do we start?

1. Chapter 3 Occupancy Classifications
   - Office – B
   - Printing Area – F-1
   - Warehouse – S-1

2. Type of Construction Table 601
   - III B

3. Size of the Proposed Building and each area
   - Building 75’ x 150’ = 11,250 sq. ft.
     - F-1 occupancy = 8500 sq.ft.
     - B occupancy = 875 sq.ft.
     - S-1 occupancy = 1875 sq.ft.

4. Table 506.2 Allowable Area
   - F-1 – 12,000 sq.ft.
   - B – 19,000 sq.ft.
   - S-1 – 17,500 sq.ft.
5. What is the allowable maximum square footage for this building?
12,000 sq. ft.

508.3 Nonseparated occupancies.
508.3.1 Occupancy classification. Nonseparated occupancies shall be individually classified
508.3.2 Allowable building area and height. The allowable building area and height of the building shall be based on the most restrictive allowances for the occupancy groups.

6. Is the proposed building compliant?
Yes, the proposal is for a 11,250 square foot building and the At is 12,000 sq.ft
We have a non-separated mixed occupancy.

Non-separated Mixed Use Example
- Each Occupancy Classified
- Most RESTRICTIVE requirements for FIRE PROTECTION
  - Applied to the entire building
  - Group M
  - Group A-2
  - Cafe
  - Retail Sales Area
  - No fire separation required
  - Group A-2 MAY require a Sprinkler THROUGHOUT the total nonseparated area
Allowable Area Determination
Section 506.2
Section 506.2.2 - Multi Occupancy and One story Buildings
For each Occupancy - use Table 506.2 and Equation 5-1
A-2 occupancy (Type VB – No Sprinkler – no frontage increase)
   - $A_a = 6,000$
M occupancy (Type VB – No Sprinkler – no frontage increase)
   - $A_a = 9,000$

NO!
The Total proposed building area is 7,000 SF
Table 506.2 allows only 6,000 SF for an A-2
   - One story, type V-B construction, No Sprinkler, No frontage increase taken
     • A-2 occupancy is 3,000 SF
     • M occupancy is 4,000 SF
     • Is this acceptable? Use Table 506.2

Non-separated Mixed Use Example
PROPOSED: Type II-B Construction - One Story - No Sprinkler System and No frontage increase taken
What is the Allowable Area??

- Based on the F-1 (most restrictive)
- Table 506.2 to 15,500 SF
Non-Separated Mixed Occupancy
Example: Hotel/Restaurant (R-1/A-2)

Proposed - Type VB Construction, NFPA 13 sprinkler system, 3 Story, and 20,000 square feet. No frontage increase taken
- The R-1 Hotel
  - Allows 3 stories (T504.4)
  - Allows 21,000 SF building area (T506.2)
- A-2 restaurant
  - Allows 2 stories
  - Allows 18,000 SF building area

Apply the MOST RESTRICTIVE HEIGHT
Limited to 2 stories by the A-2 Occupancy

Apply MOST RESTRICTIVE BUILDING AREA
18,000 square feet is Maximum size as of the A-2

508 Mixed Occupancies
Section 508.4 Separated Uses

What is the PURPOSE of FIRE AREA:
Determine sprinkler requirements
### Separated Mixed Use Example

- Each Occupancy Classified
- Each FIRE AREA may be treated separately

**FIRE PROTECTION (Chapter 9) 903.2.7**

- Group M 13,000 Sq Ft
- Retail Sales Area
- Group B (Bank) 2 hour Fire Barrier separation provided
- Sprinkler is only needed in Group M Fire Area

### Separated Occupancies

#### 508.4

**508.4 Separated Occupancies**

508.4.2 Allowable Building Area.

Determined for each STORY

Sum of the Ratios shall not exceed ONE

\[
\text{Ratio} = \frac{\text{Proposed Area}}{\text{Allowable Area}}
\]

For each USE on a story:

<table>
<thead>
<tr>
<th>Proposed Area (Proposed)</th>
<th>Allowable Area (Allowable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory (F-1) 10,000 SF</td>
<td>6,000 SF</td>
</tr>
<tr>
<td>Office (B) 6,000 SF</td>
<td></td>
</tr>
</tbody>
</table>

\[
\text{Ratio} = \frac{10,000 + 6,000}{15,500 + 23,000} \leq 1
\]

### Separated Mixed Occupancies

- Verifying the mix meets the requirements:
  - **Proposed**
    - Type II-B Construction, one story, No sprinkler, No frontage increase taken
  - **Table 506.2 allows?**
    - Factory allowed 15,500 SF
    - Office allowed 23,000 SF

\[
\text{Ratio} = \frac{\text{Proposed Area}}{\text{Allowable Area}}
\]

\[
\frac{10,000}{15,500} + \frac{6,000}{23,000} \leq 1
\]
**Verifying the Sum of the Ratios**

\[
\frac{10,000}{15,500} + \frac{6,000}{23,000} \leq 1
\]

\[
.65 + .26 = .91
\]

---

**508.4.2 Separated Occupancies**

*Example of Ratio Calculation*

**Proposed:**
- 1 story, type VB construction
- Non-sprinklered/No Frontage
  - Barbershop 900 SF
  - B (business)
  - Restaurant 4000 SF
  - A-2 assembly

**Where do we go next?**

**From Table 506.2**
- Barbershop allowed 9,000 SF
  - Ratio is 900/9000 = .10
- Restaurant allowed 6,000 SF
  - Ratio is 4000/6000 = .67

**Sum is .77 Complies**

---

**508.4 Separated Occupancies**

*508.4.3 Allowable Height*

- Each occupancy must comply based on Type of Construction
508.4.3 Separated Occupancies

Example of Allowable Stories

- **PROPOSED:**
  - Type V-B Construction
  - 3 Stories
  - No sprinkler
- **Is this allowed?**

  According to Table 504.4:
  - M can be 1 story – so OK (so far)
  - R-2 Can only be 2 story, so NO!

---

508.4.3 Separated Occupancies

Example of Allowable Stories

- **PROPOSED:**
  - Type V-B Construction
  - 3 Stories
  - Fully sprinklered (NFPA 13)
- **Is this allowed?**

  According to Table 504.4:
  - M can be 2 story
  - R-2 Can be 3 story

---

508.4.3 Separated Occupancies

Example of Allowable Stories

- **PROPOSED:**
  - Type V-B Construction
  - 2 Story Building
- **Is this allowed?**

  According to Table 504.4:
  - R-2 Can be 2 story
  - S-1 can only be 1 story, so NO!
Separated Occupancies
Section 508.4.2 Sum of the Ratios

Type II-B Construction – No Sprinkler

Sum of the Ratios:
\[
\begin{align*}
&\frac{12,000\text{ SF}}{23,000\text{ SF}} = .52 \\
&\frac{12,000\text{ SF}}{26,000\text{ SF}} = .46 \\
\text{Sum} = .98 \\
\end{align*}
\]
Complies

Example of Ratio Calculation
Type III-B, Non-Sprinklered

• Step #2:
  • First Story: Is all one use, Group M
    • Actual 10,000 SF
    • 12,500 SF Allowed
  • Third story: all Group B (no mix)
    • 10,000 SF actual
    • 19,000 allowed
  • Second story: Must be calculated
    • Business: 2,000/19,000 SF = .105
    • Educational: 8,000/14,500 = .55
    • SUM is .655, less than 1 complies

508.4 Separated Occupancies

508.4.4 Separation. … separated … in accordance with Table 508.4.

- Fire Barriers in accordance with 707
- Horizontal Assemblies as in 711
## Separated Occupancies Table 508.4

### Table 508.4 Required Separation of Occupancies (Hours)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>A, E</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>F-1, F-3</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>E-4</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>F-2</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>F-2, S-2P</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>U</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

**Group F-2 Manufacturing**

Group S-2 Storage

**Group B Offices**

**Mixed Separated Uses Example**

Non-sprinklered Building

- **NO** fire-rated separation required
- **2 hr** fire-rated separation required
508.4 Separated Occupancies

Given:
- Type IIIB Construction
- 3 Stories
- Mercantile, Office and Educational
- No Sprinkler

- Step #1: Required Separation Rating?
  Two hour fire separation is Required between
  B – E occupancies
  E – M occupancies

Incidental, Accessory and Mixed Uses Exercises

Appendix Exercise
Pages 11 & 12
First step is to calculate the sizes of each separate use.

- The total proposed area is 13,000 SF. (130’ x 100’ = 13,000 SF)
- The group M is 8,500 SF. (100’ x 90’ = 9000SF) - (10’ x 50’ = 500SF) = 8,500SF
- The office for Group M is 500 SF. (10’ x 50’ = 500SF)
- The storage room S-2 is 4000 SF. (40’ x 100’ = 4000SF)

Second step is to determine which use(s) qualifies as an “Accessory” Use (Section 508.2)?

- 10% is the limit to be accessory which means the space cannot exceed 1,300 square feet.
- The office space for the Group M is only 500 square feet so it qualifies to be accessory. Section 508.2.4 does not require it to be separated from the other occupancies.
Exercise

Third step is to determine which uses are considered a mixed use.
- The main purpose of the building is the M occupancy.
- The storage room is over the 10% so it must be a mixed use.
- We already know the office qualifies as an accessory use.

Exercise

Fourth step is to determine which type of separation is required between the mixed use(s). The choices are:
- Non rated wall
- Fire Partition
- Fire Barrier

Exercise

1. Can Wall “A” be a non-rated assembly?
2. IF the proposal is a SEPARATED MIXED USE can the wall be a Fire Partition?
3. IF the proposal is a SEPARATED MIXED USE can the wall be a Fire Barrier?
Exercise

(1) Can Wall “A” be a non-rated assembly?

Exercise

(2) IF the proposal is a SEPARATED MIXED USE can the wall be a Fire Partition?

Exercise

(3) IF the proposal is a SEPARATED MIXED USE can the wall be a Fire Barrier?
<table>
<thead>
<tr>
<th>SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Incidental use area</td>
</tr>
<tr>
<td>– Separated per Table 509</td>
</tr>
<tr>
<td>– OR treated as a Mixed Use</td>
</tr>
<tr>
<td>• MIXED Uses</td>
</tr>
<tr>
<td>– Accessory Use allowed up to 10%</td>
</tr>
<tr>
<td>• No separation required</td>
</tr>
<tr>
<td>– <strong>Non-Separated Mixed Use</strong>, most restrictive</td>
</tr>
<tr>
<td>– <strong>Separated Mixed Use</strong>, Sum of the Ratios</td>
</tr>
</tbody>
</table>
Lesson 5
Location on the Property

Chapters 6 and 7
Exterior Walls and Location on the Property
Preventing Exterior Fire Spread

Preventing Exterior Fire Spread
Issues and Concerns:

- Fire Separation Distance
  - Lot Lines and Imaginary Property Lines
- Exterior Wall Construction
  - Fire Resistance Ratings from Chapter 6
- Openings in the Exterior Wall
  - Fire Protection Ratings from Chapter 7
**Definition: Fire Separation Distance**

The distance measured from the building face to one of the following:

1. The closest Interior Lot Line;
2. To the Centerline of a Street, an Alley or Public Way; or

The distance shall be measured at right angles from the face of the wall.

---

### Table 601 Fire-resistance Rating Requirements For Building Elements (Page 117)

<table>
<thead>
<tr>
<th>BUILDING ELEMENT</th>
<th>MIN. FIRE-RATING</th>
<th>CLEARANCE</th>
<th>OCUPANCY GROUP</th>
<th>OCUPANCY GROUP</th>
<th>OCUPANCY GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary structural frame (see Section 222)</td>
<td>3’</td>
<td>0’</td>
<td>1’</td>
<td>0’</td>
<td>0’</td>
</tr>
<tr>
<td>pony wall</td>
<td>2’</td>
<td>1’</td>
<td>0’</td>
<td>1’</td>
<td>0’</td>
</tr>
<tr>
<td>Interior wall</td>
<td>2’</td>
<td>1’</td>
<td>0’</td>
<td>1’</td>
<td>0’</td>
</tr>
<tr>
<td>Exterior wall</td>
<td>2’</td>
<td>1’</td>
<td>0’</td>
<td>1’</td>
<td>0’</td>
</tr>
</tbody>
</table>

---

### Table 602 Fire-Resistance Rating for Exterior Walls

<table>
<thead>
<tr>
<th>FIRE MAGNITUDE (X)</th>
<th>TYPE OF CONSTRUCTION</th>
<th>OCCUPANCY GROUP</th>
<th>OCCUPANCY GROUP</th>
<th>OCCUPANCY GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>X ≤ 5’</td>
<td>All</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5 &lt; X ≤ 10</td>
<td>OA</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10 &lt; X ≤ 30</td>
<td>OA, OB</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>X &gt; 30</td>
<td>All</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Fire Separation Distance Table 602
Buildings on Different Lots

Type VII

EXISTING
BUILDING

NEW
BUILDING

Type IIIB

M Occupancy

Type IVB

<table>
<thead>
<tr>
<th>BUILDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type IIIB construction</td>
</tr>
<tr>
<td>M Occupancy</td>
</tr>
</tbody>
</table>

B Occupancy

EXISTING
BUILDING

LOT
LINE

706.4 Fire-resistance rating

Walls that are located on lot lines between adjacent buildings to be constructed as fire walls and be rated in accordance with Table 706.4.

<table>
<thead>
<tr>
<th>TABLE 706.4</th>
<th>FIRE WALL FIRE-RESISTANCE RATINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP</td>
<td>FIRE-RESISTANCE RATING (hours)</td>
</tr>
<tr>
<td>A, B, E, H-4, I, R-1, R-3, U</td>
<td>3h</td>
</tr>
<tr>
<td>F-1, H-7, H-5, M, S-1</td>
<td>1h</td>
</tr>
<tr>
<td>R-1, R-2</td>
<td>4h</td>
</tr>
<tr>
<td>F-2, S-2, R-3, R-4</td>
<td>2h</td>
</tr>
</tbody>
</table>

a. In Type II or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.
b. For Group II-1, II-2, or III-3 buildings, also see Sections 415.7 and 415.8.
What is the occupancy?
What is the construction type?
Examples of Tables 601 and 602

- **Table 601**: Based on Construction
  - Type VB Building
    - Requires a “0” Hour Rated Exterior Bearing Wall

- **Table 602**: Based on Distance
  - >5’ <10’, M Occupancy - Type VB Building
    - Requires a “1” Hour Fire Resistance Rated Exterior Wall

Fire Separation Distance Section 705.3
Buildings on the Same Lot

- Imaginary Lot Line Location
  - Based on the Existing Building
  - Exterior Wall and Opening Protection complies
    - Sections 705.5 and Section 705.8

- Two exceptions:
  - Total Size
  - S-2 Parking Garages of Type I or Type II

Fire Separation Distance Section 705.3
Buildings on the Same Lot

- Section 705.3 Exception – buildings may be treated as one
- Aggregate Area does not exceed Allowable Area.
Fire Separation Distance Section 705.3  
Buildings on the Same Lot

Type IIB construction  
B Occupancy  
EXISTING

NEW BUILDING

<table>
<thead>
<tr>
<th>Fire Separation Distance (R)</th>
<th>Construction Type</th>
<th>Group II</th>
<th>Group F-I, M, S-I</th>
<th>Group</th>
<th>Group J, F-2, I, R, Bp, M, S, U</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>ALL</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>≥ 5 &lt; 10</td>
<td>IA</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>≥ 10 ≥ 30</td>
<td>IA, IB</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>≥ 30</td>
<td>ALL</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Exercise Appendix Pg. 14

A Division of New York Department of State
### Fire Separation Distance Section 705.3

**Buildings on the Same Lot**

<table>
<thead>
<tr>
<th>Fire Separation Distance (ft.)</th>
<th>Construction Type</th>
<th>Group H</th>
<th>Group F-1, M, S-1</th>
<th>Group A, B, E, F-2, L, R(b), S-2, U</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>ALL</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>≥ 5 - 10</td>
<td>IA</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>≥ 10 - 30</td>
<td>IA, IB, IIB, IV</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>≥ 30</td>
<td>All</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Imaginary Lot Line

- Type IB construction
- B Occupancy
- EXISTING BUILDING
- M Occupancy Type IIB construction
- NEW BUILDING

### Exterior Walls Openings

Section 705.8

- **Based on Fire Separation Distance**
  - **Create a balance:**
    - ALLOWABLE AREA of Openings
    - FIRE PROTECTION Provided

- **Greater than 30′, openings are not limited**
- **20′ – 30′, no limit if protected**
- **5′ – 20′, protected or unprotected**
- **3′ – 5′, protected openings only**
- **3′ or less, openings NP**
Table 705.8 Partial View (Page 126)

<table>
<thead>
<tr>
<th>Degree of Opening Protection</th>
<th>Maximum Allowable Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unprotected, Not Sprinkled</td>
<td>0'</td>
</tr>
<tr>
<td>Unprotected, Sprinkled</td>
<td>10%</td>
</tr>
<tr>
<td>Protected</td>
<td>10%</td>
</tr>
</tbody>
</table>

Example

Exterior Walls – Non-sprinklered Building with Unprotected Openings

- FSD 5' < 10' = 10% allowable unprotected openings
- There is no sprinkler system in the building
- 100 sq. ft. permitted; 80 sq. ft. proposed

Example Equation 7-2

Exterior walls with protected and unprotected openings:

- Where both unprotected and protected openings proposed at a story, combined area at each story shall comply with:

\[
\frac{A_p + A_u}{a_p + a_u} < 1
\]
Example

Exterior Walls - Non-sprinklered Building with Unprotected Openings

- FSD >5' <10' = 10% allowable unprotected openings
- There is no sprinkler system in the building
- 100 sq. ft. permitted; 110 sq. ft. proposed

Example

Exterior Walls - Non-sprinklered Building Unprotected and Protected Openings

Change the door to a Protected Opening

\[ \frac{A_p}{A_u} < \frac{1}{100} \]

Example

Exterior Walls - Non-sprinklered Building Unprotected and Protected Openings

\[ \frac{A_p}{A_u} = \frac{20}{90} \]

\[ \frac{A_p}{A_u} = \frac{250}{100} \]

\[ \frac{20}{250} + \frac{90}{100} \leq 1 \]

\[ .08 + .9 = .98 \leq 1 \]
Allowable Area of Openings

Student Exercise
Appendix page 14
Allowable Area of Openings

- Exterior wall 12' from interior property line
- Protected/unprotected openings as shown
- Non-sprinklered building
- Determine if the areas of unprotected openings are permitted

---

**Allowable Area of Openings Variable Values**

**Step 1)** Figure the Wall area

**Step 2)** Figure what the \( A_p \) is (Actual area protected openings)

**Step 3)** Figure what the \( A_p \) is (Allowable area protected openings) (Table 704.8)

**Step 4)** Figure what the \( A_u \) is (Actual area of unprotected openings)

**Step 5)** Figure what the \( A_u \) is (Allowable area unprotected openings) (Table 704.8)

---

**Allowable Area of Openings Calculations**

\[ A_p = \text{Actual Protected} \quad \text{SF} \]
\[ A_u = \text{Actual Unprotected} \quad \text{SF} \]

\[ A_p + A_u \leq 1.0 \]

\[ a_p \quad a_u \]
Chapter 4
Special Detailed Requirements Based on Use and Occupancy

**Hazardous Occupancies**

**Group H Occupancies**

Section 415.6  Fire Separation Distance

- Group H-2 or H-3
  - not less than 25% of the perimeter wall of the occupancy shall be an exterior wall

**Group H Occupancies Section 415.6.1 Minimum Fire Separation Distance**

- ONLY for Group H
  - Measure from occupancy wall, even when they are interior to the structure
  - Measure to lot line, including public way
Group H Occupancies Section 415.6
Fire Separation Distance

Section 415.6.1
- Sections 415.6.1.1 through 415.6.1.4
- Provide specific minimum distance based on the H use

Additional Qualifiers:
- Detached Buildings and Table 415.6.2

Section 415.6.1.1 Group H-1.
- Not less than 75 feet and required by the Fire Code.
  - Exception: Fireworks manufacturing buildings separated in accordance with NFPA 1124.

Section 415.6.1.2 Group H-2
- Where the area of the occupancy is greater than 1,000 square feet
  - Not less than 30 feet
  - Detached building not required

Section 415.6.1.3 Groups H-2 and H-3
- Not less than 50 feet (15 240 mm) where a detached building is required
  - see Table 415.6.2 for Detached Buildings
Group H Occupancies Section 415.6
Fire Separation Distance

• [F] Section 415.6.1.4 Explosive materials.
  Group H-2 and H-3 occupancies containing materials with
  explosive characteristics
  – Separated as required by the Fire Code.
  – Where separations distances are not specified
    • Shall be determined by a technical report issued in accordance
      with Section 414.1.3.

Detached Buildings
Table 415.6.2 (Page 83)

• Materials Listed … on Table 415.6.2
  – Match up with categories of H-1, H-2 and H-3
  – H-5 is not excluded
  – Footnote b - Table 307.1(1)

• When these quantities are exceeded
  – Detached Building is Required

Summary
Preventing Exterior Fire Spread

Issues and Concerns:
• Fire Separation Distance
  – Lot Lines and Imaginary Property Lines
• Exterior Wall Construction
  – Fire RESISTANCE Ratings from Chapter 6
• Openings in the Exterior Wall
  – Fire PROTECTION Ratings from Chapter 7
Lesson 6
Passive Fire Protection Concepts

Maintain Structural Integrity
Restrict the Spread of a Fire

In this Section …
How Passive Protection is Achieved

- What is FIRE RESISTANCE and how is it established?
- What types of fire-resistance RATED ASSEMBLIES are there?
- Why and how are COMPARTMENTS created, and what are they called?
- How are GAPS and OPENINGS treated to maintain the protection of the compartment?

Section 703.2
Fire-resistance Ratings
Determination of Fire Resistance

ASTM Time-Temperature Curve
ASTM E-119 Test procedure: Wall and Floor Assemblies

Schematic of Wall Furnace
1 - furnace
2 - flue
3 - observation ports
4 - gas burners
5 - thermocouple tubes
6 - loading jacks
7 - restraining frame
8 - specimen

Schematic of Floor Furnace
1 - furnace
2 - flue
3 - gas burners
4 - observation ports
5 - restraining frame
6 - thermocouple tubes
7 - specimen

Section 703.3
Fire Resistance Alternative Method 1

Fire-resistance

- Safety Issues and Interior Finish Materials
  - The rapid spread of fire
  - Contribution of fuel to the fire

- Test Standards
  - Walls and Ceilings
    - ASTM E-84 Surface Burning Characteristics
    - Flame spread and Smoke Developed
  - Floors
    - NFPA 253 Critical Radiant Flux
    - Flame spread and Heat Release
Chapter 8 Interior Finishes
Section 803 Wall and Ceiling Finishes

• ASTM E-84 - The "Steiner Tunnel Test" or UL 723

<table>
<thead>
<tr>
<th>Flame Spread Range</th>
<th>Smoke Developed Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0-25</td>
</tr>
<tr>
<td>B</td>
<td>26-75</td>
</tr>
<tr>
<td>C</td>
<td>76-200</td>
</tr>
</tbody>
</table>

• Look at Table 803.13 (Page 211)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SPRINKLERED</th>
<th>NONSPRINKLERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior</td>
<td>exit stairways, interior exit ramps and exit passageways, corridors and enclosure for exit access stairways and exit access ramps</td>
<td>Rooms and enclosed spaces</td>
</tr>
<tr>
<td>Interior</td>
<td>exit stairways, interior exit ramps and exit passageways, corridors and enclosure for exit access stairways and exit access ramps</td>
<td>Rooms and enclosed spaces</td>
</tr>
</tbody>
</table>

Chapter 8 Section 803 Wall and Ceiling Finishes

• Look at Table 803.13 (Page 211)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SPRINKLERED</th>
<th>NONSPRINKLERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
</tbody>
</table>

Chapter 8 Interior Finishes
Section 803.5 Textile Wall Coverings

• Woven, Nonwoven, Napped, Tufted, Looped or similar and Carpet

• Where used as Wall Coverings
Chapter 8
Section 804 Interior Floor Finish

• 804 applies to finishes OTHER THAN …
  – Traditional finishes not comprised of fibers
• Classification NFPA 253
  – Class I = 0.45 w/sq. cm
  – Class II = 0.22 w/sq. cm
• 804.4.2 Minimum critical radiant flux
  – Based on Occupancy

Fire-resistance Rated Assemblies

Names and Definitions
Location of details in the Code

Important Details
Fire Separation Assemblies

• MATERIALS of Construction
• Fire Resistance RATING
• Where does it start and where does it end - CONTINUITY

When “other” parts of the code require a fire resistance rated element … Chapter 7 tells us how to build it so it works!
General Rules
Differences will be noted as appropriate

- Supporting Construction:
  - The supporting construction shall be protected to afford the required fire-resistance rating of the element supported

- Materials allowed
  - As permitted by the type of construction

Openings:
Openings in ______ shall be protected in accordance with Section 716

Penetrations:
Penetrations through ______ shall comply with Section 714

Joints:
Joints made in or between ______ shall comply with Section 715

Duct and Air Transfer Openings:
Penetrations by duct and air transfer openings shall comply with Section 714 and Section 717

Categories of Fire Separation Assemblies
- Fire Wall - creates separate BUILDINGS
- Fire Barrier – deck to deck
- Fire Partition - vertical only
- Smoke Barrier - smoke containment membrane
- Smoke Partition – wall assembly to limit smoke movement
- Floor and Roof Assemblies - where horizontal assemblies require ratings
- Shaft Enclosures -
Student Research

• Find the Details for Fire Walls. What Code Section?
  
  – DON'T ALWAYS BELIEVE ME! Find the TEXT that tells us a Fire Wall creates separate buildings!
  
  – What is a Party Wall?

Student Research

• What does Section 503.1 tell us about Fire Walls?
Fire Wall
706.2 Structural Stability

- Allow Collapse
- on One Side

---

Masonry Fire Wall
Structural Stability

- Self Supporting
- Structural Independence
  on either side

- "Fire cuts"

Floor collapses without causing damage to Fire Wall

---

A Division of New York Department of State
Gypsum Area Separation Wall
Structural Independence

Fire Wall
Technical Requirements

- Section 706.3 Fire wall materials shall be NONCOMBUSTIBLE except for Type V buildings
- Table 706.4 Minimum FIRE RESISTANCE ratings based on use group:

<table>
<thead>
<tr>
<th>Use Group</th>
<th>Minimum Fire Resistance Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups A, B, E, H-4, I, R-1, R-2, U</td>
<td>3 hour*</td>
</tr>
<tr>
<td>Groups F-1, H-3, H-6, M, S-1</td>
<td>3 hour</td>
</tr>
<tr>
<td>R-7, R-9, R-13</td>
<td>4 hour*</td>
</tr>
<tr>
<td>F-2, S-2, R-3 and R-4</td>
<td>2 hour</td>
</tr>
</tbody>
</table>
Fire Walls Section 706.5
Horizontal Continuity

- Exterior Wall to Exterior Wall
- Extend 18”
  - With Exceptions

How many fire walls do you see in this motel building? There are 5 so this is actually considered 6 buildings. They recently had a fire and it was contained to the two story portion of this motel. Fire Walls do their job!
Fire Wall Section 706.5
Horizontal Continuity

- Detail for Exceptions 1, 2 and 3
- Exterior Wall Intersection

5/8"

TYPE X

GYPSUM WALLBOARD

2" – 1"

GYPSUM LINER PANELS

EXTERIOR SHEATHING

2"

C TRACK

Fire Walls Section 706.6
Vertical Continuity

- GENERAL RULE: Continuous from the Foundation to at least 30" above either Roof
- Called a PARAPET Wall
- NOTE:
  - There are many exceptions
Fire Barrier

202 Definition

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

Fire Barriers

Section 707.5 - Continuity

- Deck to Deck
  - Do not terminate at the ceiling
- Securely attach at top and bottom.
- Extend continuously through concealed spaces
- Fireblock within fire barrier at each floor level.
- Fire Rated Supporting construction

Exercise

Fire-resistance Rated Assemblies

Appendix Page 15 (top half)
Questions 1, 2, and 3
1) Find at least 10 situations where the Code requires a FIRE BARRIER:

2. What are the non-sprinklered and sprinklered hourly values between Groups H-3 and I-3 in a Type III-A building, per Table 508.4?
2. What are the non-sprinklered and sprinklered hourly values between Groups H-3 and I-3 in a Type III-A building, per Table 508.4?

in a Sprinklered Building

in a Non-Sprinklered Building

3. What are the non-sprinklered and sprinklered hourly values between fire areas within Group M in a Type V-B building, per Table 508.4?
Fire Partition
202 Definition

• FIRE PARTITION. A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.

• Section 708.1 Where Required: To Separate …
  – Separation Walls in Groups I-1, R-1, R-2 and R-3
  – Tenant spaces in covered and open malls
  – Corridor walls
  – Elevator lobby

Fire Partition Details
Section 708.3 Fire-resistance Rating

• One hour Fire-resistance Rating

• Exceptions:
  – Corridor walls ½ per Table 1020.1
  – 1/2-hour at dwelling unit and guest room separations in sprinklered Types IIB, IIIB, and VB

Fire Partitions
708.4 Continuity

• Details similar to a Fire Barrier. Differences shown in italics.
  – Deck to Deck OR to Rated Ceiling
  – Securely attach, top and bottom
  – Extend through concealed spaces, EXCEPT where it stops at Rated Ceiling
  – If combustible construction, fireblock/draftstop concealed space above partition
  – Fire rate supporting construction same as fire partition EXCEPT tenant/sleeping unit separations and corridors in Types IIB, IIIB, and VB.
Vertical Openings and Shaft Enclosures

Definitions: 202

Shaft
An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof.

Shaft Enclosure
The walls of construction forming the boundaries of a shaft.

Vertical Openings
- Section 712.1.1 through 712.1.16 covers:
  - Shaft Enclosure
  - Within Individual Dwelling Units
  - Escalator Openings
  - Penetrations
  - Ducts
  - Ablums
  - Masonry Chimney
  - Two-story Openings
  - Parking Garages
  - Mezzanine
- Protected as required by their sections of the code

Shaft Enclosures
- Section 713 covers:
  - Vertical Exhaust Ducts
  - Gas Flues
  - Metal Chimneys
  - Vertical Supply Ducts
  - Return and Outdoor Air Ducts
  - Elevator Hoist ways
  - Linen and Trash Chutes
Vertical Openings and Shaft Enclosures

- **Section 713.1 - Shaft Enclosures**
  - General. Protect openings and penetrations through floor/ceiling and roof/ceiling assemblies.
  - Interior exit stairways and interior exit ramps shall be protected in accordance with Section 1023.

- **Section 713.2 - Construction.**
  Shaft enclosures shall be constructed as fire barriers or horizontal assemblies, or both.

- **Section 713.3 - Materials.**
  The shaft enclosure shall be of materials permitted by the building type of construction.

- **Section 713.4 - Fire-resistance rating.**
  Shaft enclosures shall have a fire-resistance rating of:
  - Not less than 2 hours where connecting four stories and up.
  - Not less than 1 hour where connecting less than four stories.
  - Stories shall include basements but not mezzanines.
  - Shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.
  - Shall meet the requirements of Section 703.2.1.
Compartments for Fire and Life Safety

- Compartments that keep the fire and smoke IN, and
- Compartments that keep the fire and smoke OUT!

Compartments and CONTAINMENT

- Building Height and Area
- FIRE AREA
- CONTROL AREA
- Smoke Compartment
- Egress Components
- Spaces with additional fuel and/or ignition sources

To Create the Compartment ...

Provide Fire Resistant Construction

- Exterior Wall
- Fire Wall
- Fire Barrier
- Shaft Enclosure
- Fire Partition
- Smoke Barrier
- Smoke Partition
- Horizontal Assemblies
The KEY to this Topic  
Compartments for Fire Safety

- Understand the need for a compartment
- Check the details for each feature individually
- Recognize that everything revolves around containment of fire and/or smoke

Fire Area  
Definition 202

- **FIRE AREA.** The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building. Areas of the building not provided with surrounding walls shall be included in the fire area if such areas are included within the horizontal projection of the roof or floor next above.

FIRE AREAS Created With FIRE BARRIERS or HORIZONTAL ASSEMBLIES

- **Section 707.3.10 Fire areas.** Separating a SINGLE OCCUPANCY into different fire areas ... Table 707.3.10. (Page 131)

<table>
<thead>
<tr>
<th>OCCUPANCY GROUP</th>
<th>FIRE-RESISTANCE RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-1, H-2</td>
<td>4</td>
</tr>
<tr>
<td>F-1, H-1, S-1</td>
<td>2</td>
</tr>
<tr>
<td>A, B, E, F-2, H-4, H-5, I, M, R, S-2</td>
<td>2</td>
</tr>
<tr>
<td>U</td>
<td>1</td>
</tr>
</tbody>
</table>
... separating fire areas of MIXED OCCUPANCIES ... not less than the highest value indicated in Table 707.3.10 ...

- Mixed Use = Table 508.4
- Fire Area = Table 707.3.10
Regulation of Hazardous Materials

• Control Area - Definition 202
Spaces within a building where quantities of HAZARDOUS MATERIALS not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled. See also the definition of “Outdoor control area” in the Fire Code of New York State.

Per Control Areas

<table>
<thead>
<tr>
<th>Material</th>
<th>Class</th>
<th>Group if Quantity Exceeded</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible Fiber</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loose Baled</td>
<td>H-3</td>
<td>Solid pound (cubic ft.) Liquid gallons (pounds)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H-3</td>
<td>(100)</td>
</tr>
<tr>
<td>Flammable Liquid*</td>
<td></td>
<td>H-2 or H-3</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>IA IIB and IIC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Control Areas**

**Section 414.2 Specific Details**

- Separated by Fire Barrier and Horizontal Assemblies
- Quantity percentage per Table 414.2.2
- Maximum Number per Table 414.2.2
- Fire Resistance per Table 414.2.2
  - Minimum 2 hour Floor Construction including support
  - Exception may allow 1 hour

**Control Areas**

**Design and Number of Table 414.2.2**

<table>
<thead>
<tr>
<th>Above grade level</th>
<th>Percentage of the maximum allowable quantity per control area</th>
<th>Number of control areas per story</th>
<th>Fire resistance rating for fire barriers in hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher than 9'</td>
<td>50</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Below grade level</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower than 2'</td>
<td>75</td>
<td>3</td>
<td>Not allowed</td>
</tr>
</tbody>
</table>

**Fire Resistant Assemblies**

**Maintaining the Integrity**

- Section 714 Penetrations
- Section 715 Fire-resistant Joint Systems
- Section 716 Opening Protectives
- Section 717 Ducts and Air Transfer Openings
Penetrations Section 714
Protection for Fire-resistance Rated Assemblies

What is a Penetration
• Examples include:
  – Holes for pipes, conduit, wire, ducts
• 2 Categories:
  – Through-Penetration
    • Passes through entire assembly
  – Membrane Penetration —
    • Opening in 1 side of assembly

Penetrations

Section 714.4.1 Through penetrations. Through penetrations of fire-resistance-rated walls shall comply with §714.4.1.1 or §714.4.1.2.

• Penetration protection is part of the ASTM E-119 or UL 263 tested assembly
• Protection provided by a tested firestop system

Penetrations

• Appropriate for Walls and Horizontal Assemblies
• Test replicates ASTM E 119 on a small scale
Wall Penetrations

Section 714.4.2 Membrane Protection Details

- Exception #1: Steel electrical boxes
  - Not exceeding 16 sq. in.
  - 100 square inch of box per 100 square foot of wall area
  - Separated on opposite sides of the wall

- Exception #2: Listed electrical boxes

Horizontal Assemblies

- Section 714.5.2 Membrane penetrations. Penetrations of membranes … have to comply with either Section 714.5.1 or 714.5.2
- Penetration protection is part of the ASTM E-814 tested assembly
- Protection provided by a tested firestop system

Membrane Penetration

Components tested per ASTM E 119

- UL Design No. P513
- 1 ½ hour assembly

Item #12: Damper … held open with a fusible link (Bearing the UL Listing Mark)

Item #13: Fixture (Bearing the UL Listing Mark)

Item #14: Fixture Protection – Wallboard, Gypsum
Opening Protective

Assembly of materials and accessories, including frames and hardware, installed in a wall, partition, floor, ceiling or roof opening to prevent, resist or retard the passage of fire, flame, excessive heat or hot gases.

Section 716 Opening Protectives organization

716.1 ...required by other sections ...

[NY] 716.1.1 Alternate methods for Fire Protection Ratings

716.2 Fire Door Assemblies

716.3 Fire Window Assemblies

---

Swing Type Fire Door Assembly

FIRE DOOR ASSEMBLY
Any combination of a fire door, frame, hardware, and other accessories that together provide a specific degree of fire protection to the opening.

- Tested Assembly OR an Assembly of Tested Components

---

Door and Frame Labels

- Labeled at the Factory – NOT at the Job Site
Opening Protective Components of the Assembly

- Self Closing, Automatic Closing, or Delayed-action closers
- Latch required

Opening Protective Rolling Fire Shutter

Service Counter Fire Door

Minimum Fire Protection Ratings

- Section 716.2 Fire door and shutter assemblies
  - Installed per NFPA 80
  - Minimum rating per Table 716.1(2)
- Glazing Permitted in MOST Fire Door Assemblies
Section 716.2 Fire door assemblies.

Section 716.2.9.5 Labeling.
– Comply with Table 716.1(1)
D - indicates the glazing shall be used in a door assembly and the glazing meets the fire resistance requirements of the test standard

NH - indicates the glazing does not meet the hose stream requirements of the test (allowed for 20 minute rating only)

NT - indicates glazing does not meet temperature rise criteria

XX - symbolizes fire protection rating period, in minutes (minimum 20 minutes)

DOOR LABEL

H - indicates glazing meets the hose stream test requirements of the test standard (required for 45 minutes and above)

T - indicates glazing meets temperature rise criteria

DOOR LABEL

Ducts and Air Transfer Openings
Introduction - Section 717
Ducts and Air Transfer Openings

• **Rule Number 1**: If it penetrates a Fire-resistance Rated Assembly, provide the appropriate damper

• **Rule Number 2**: If there is an exception and a damper is not required, fire stop around the duct

Ducts & Air Transfer Openings

Types of dampers

• Fire damper
• Smoke damper
• Ceiling radiation damper
• Combination fire/smoke

Dampers

Section 717.5 Where Required

• Fire Wall – fire damper
• Fire Barrier – fire damper
• Shaft Enclosure – fire and smoke damper
  – Ducts not allowed to penetrate exit enclosure
• Fire Partitions – fire damper
• Corridors – smoke damper*
• Smoke Barrier – smoke damper
Summary
Passive Fire Protection

- Based on FIRE RESISTANCE
- Vertical and Horizontal ASSEMBLIES with FIRE RESISTANCE RATINGS
- COMPARTMENTS for life safety and property protection
- Maintain the INTEGRITY by protecting openings, penetrations and joints
Lesson 7
Active Fire Protection

Detection, Notification, Suppression
and Control through technology

In this portion of the course …

- Describe the different types of equipment and systems used in Fire Safe Design
  - What they are
  - Why it’s important
  - How they work
- Locate the applicable information within the Code

The specific topics in this series include …

- Fire Suppression Equipment
- Portable Fire Extinguishers
- Fire Alarm and Detection Systems
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General Organization

- Each section specific to fire protection or life safety feature
- Requirements for installation the same in both Building Code and Fire Code
- Maintenance requirements added in the Fire Code
Supervisory Service

- Section 901.6 Building Code
  - Supervisory Service for NEW Systems
    - Section 901.6.1 Automatic Sprinkler Systems
    - Section 901.6.2 Integrated Testing
    - Section 901.6.3 Fire Alarm Systems
    - Section 901.6.4 Group H

Organization Example
§903 Sprinkler Systems

- 903.1 General requirements
- 903.2 Where required
- 903.3 Installation requirements
- 903.4 Sprinkler system supervision and Alarms
- 903.5 Testing and maintenance
- 903.6 Existing buildings

Fire Code Section 903

- Section 903.2 Where Required
  - 903.2.1 through 903.2.12
Fire Suppression Systems

- Automatic Sprinkler Systems
- Alternative Systems
- Standpipe Systems

MYTHS AND FACTS ABOUT AUTOMATIC FIRE SPRINKLERS

Myth 1: "Water damage from a sprinkler system will be more extensive than fire damage."

Myth 2: "When a fire occurs, every sprinkler head goes off."

Myth 3: "A smoke detector provides enough protection."

Myth 4: "Sprinklers are designed to protect property, but are not effective for life safety."

How does a Sprinkler System Work?

- This is a HEAT ACTUATED valve
  The fusible link melts or breaks.
How does a Sprinkler System Work?

- This is a HEAT ACTUATED valve
- Connected to a WATER SUPPLY

Imagine a few pipes along the way...

If a FIRE occurs, the HEAT RISES
- When sufficient heat rises to the SPRINKLER HEAD ...
- the valve OPENS

When the VALVE OPENS, the WATER COOLS the FIRE
In this section …

• Describe the 4 basic types of Sprinkler Systems
• For a list of occupancies, determine whether a Sprinkler System is required
• Identify 5 types, and 3 classes of Standpipe Systems
• Determine Standpipe requirements for a multi-story building

Types of Sprinkler Systems

Wet Pipe

Types of Sprinkler Systems

Dry Pipe
Types of Sprinkler Systems

**Pre-Action**

- Sprinkler fire
- Closed sprinkler head activated by heat from fire
- Pre-action valve

**Deluge**

- Deluge valve
- Water flow

System Components

**Sprinkler Operation**

- Fusible links
- Liquid filled glass bulbs
System Components
Sprinkler Characteristics

- Temperature Rating
- Thermal Sensitivity and Response

September 23, 2020

System Components
Sprinkler Characteristics

- Orientation and Appearance

September 23, 2020

Concealed Sprinklers

Concealed Head / White Cover Plate
Concealed Head / Brass Cover Plate

September 23, 2020
Piping Terminology and Components

- FEEDER MAIN from the WATER SUPPLY
- Vertical sections are RISERS
- CROSS MAINS are horizontal and feed BRANCH LINES
- Entire system is supported by HANGERS and CLAMPS
System Components
Indicating Control Valve
Post Indicating
Outside Stem and Yoke (OS&Y)

System Components
Fire Department Connection

System Components Alarm Devices
- Flow switch
- Water motor gong
- Tamper switch
Required Locations for Automatic Sprinkler Systems

Student Exercise
Appendix page16&17

Sprinkler Exercise
1. Single story, office building, 30,000 SF in area

- Occupancy classification:
- Required or Not-required:
- Where in the building:
- Code citation:

Sprinkler Exercise
2. A restaurant occupies the third story of an office building

- Occupancy classification:
- Required or Not-required:
- Where in the building:
- Code citation:
3. A single story motel

- Occupancy classification: Group R-1
- Required or Not-required: Required
- Where in the building: Throughout the building
- Code citation: 903.2.8

**ALL R's require sprinkler systems**

4. A Woodworking Factory, 10,000 SF at grade

- Occupancy classification:
- Required or Not-required:
- Where in the building:
- Code citation:

5. A semiconductor manufacturing facility

- Occupancy classification:
- Required or Not-required:
- Where in the building:
- Code citation:
Sprinkler Exercise

6. A four story department store

- Occupancy classification:
- Required or Not-required:
- Where in the building:
- Code citation:

Extra Credit: A 10 story office building designed for 100 people on each story.

- Occupancy classification:
- Required or Not-required:
- Where in the building:
- Code citation:

[F] 903.2.11.3

Buildings 55 feet or more in height.

Buildings with a floor level, with 30 or more occupants, located 55 feet above the lowest level of fire department vehicle access

Exceptions:
- Open Parking Structures
- Occupancies in Group F-2
Sprinkler Systems Required
[F] 903.2.11.6 Other Required Systems

• In ADDITION to the rest of 903.2
• Specific Buildings and Areas based on the USE
• Coordinates with other sections of the Building Code and with the Fire Code
• Table 903.2.11.6

Fire Sprinkler Systems
§903.3.1 Installation Standards

• 903.3.1.1 NFPA 13
• 903.3.1.2 NFPA 13R
  – Where allowed in Group R
• 903.3.1.3 NFPA 13D
  – Where allowed in One- and Two Family Dwellings

Section 904
Alternative Extinguishing Systems

• 904.1 General requirements
• 904.2 Where permitted
• 904.3 Installation
• 904.4 Inspection and Testing
• 904.5 - 904.11 Types of agents
• 904.12 Commercial Cooking Systems
• 904.13 Domestic Cooking Systems in I-1, I-2 & R-2
• 904.14 Aerosol Fire-Extinguishing Systems
Section 905
Standpipe Systems

NFPA 14 is the Installation Standard

1 ½ inch hose connection

2 ½ inch FD connection

Standpipe Terminology

Types of Systems

• Automatic Dry Standpipe
• Automatic Wet Standpipe
• Manual Dry Standpipe
• Manual Wet Standpipe
• Semiautomatic dry

Where in the code do you find this?

See definitions

Standpipe Terminology

Class of System

• Class I
  – For trained personnel (2 ½ connection)
• Class II
  – Primarily for occupants (1 ½ connection)
• Class III
  – Combination (both 1 ½ and 2 ½ connections)

See definitions
Standpipe Systems
Organization of Section 905

• When is a Standpipe required?
  – 905.3.1 through 905.3.8
• IF required, how are hose connection locations determined?
  – 905.4 Class I connection
  – 905.5 Class II connection
  – 905.6 Class III connection

Student Activity
Appendix page

• If the Corning Tower were constructed today, would a Standpipe system be required?
• If so, what are the important details?
  – System type and locations

Student Activity
Appendix page

• Standpipe system required?
• Important details?
  – Class III system (with possible exceptions)
  – 905.6 Location of Class III connections
  • Meet the requirements for both Class I and Class II locations
  – 905.4 Class I locations
  – 905.6 Class II locations
Code Research

• Find the requirements for Fire Extinguishers in the Fire Code.

Portable Fire Extinguishers

Section 906

• 906.1 Where required by this section
And as required by Table 906.1

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<td>308.1.3</td>
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Portable Fire Extinguishers

Section 906

• §906.2 General
  – Selected, installed and maintained … this section and NFPA 10 (2018)
• §906.3 Size and Distribution
  – Selected and placed
• §906.4 Cooking grease fires
• §906.5 through §906.10 Installation Details
NFPA 10 Chapters (2018)

- General Requirements
  - Classifications and Hazards
- Selection of Extinguishers
- Installation of Extinguishers
- Inspection, Maintenance and Recharging
- Hydrostatic Testing

Fire Extinguishers

A: Ordinary Combustibles
B: Flammable Liquids
C: Electrical Equipment
D: Combustible Metals
Fire Extinguishers

• **Class K** - Cooking Materials (Cooking oils/fats/grease)

Fire Alarm and Detection Systems

Chapter 9
Building Code of New York State

Contents of Section 907

Fire Code
- §907.1 General
- §907.2 Where Required
- §907.3 Fire Safety Functions
- §907.4 Initiating Devices
- §907.9 Where Required in Existing Buildings and Structures
FIRE ALARM SYSTEM
A system ... consisting of components and circuits arranged to monitor and annunciate the status of fire alarm (device) or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

What is an Alarm System?
- It starts with an INITIATING DEVICE

What is an Alarm System?
- AUTOMATIC Initiating Devices
  - Smoke
  - Heat
  - Flame
  - Gas Sensing
What is an Alarm System?

It ends with a NOTIFICATION APPLIANCE

- AUDIBLE ALARM
- NOTIFICATION APPLIANCE

- It is Coordinated by the FIRE ALARM CONTROL UNIT
  - Monitor the components and circuits
  - Annunciate the status
  - Activate the appropriate response
- This is the basic LOCAL ALARM SYSTEM

Local Protective System

- This basic configuration monitors and notifies the "PROTECTED PREMISES"
Supervisory Service

In addition to the local protection

- Turn to:
  - 901.6 in the Building Code
- What is a SUPERVISORY SERVICE?
  It monitors the LOCAL system and notifies response personnel at a SUPERVISORY STATION in accordance with NFPA 72

Central Station Service

Central Station Def.

Central Station Service Alarm System. A system or group of systems in which the operations of circuits and devices are transmitted automatically to, recorded in, maintained by, and supervised from a listed central station that has competent and experienced servers and operators who, upon receipt of a signal, take such action as required by this Code. Such service is to be controlled and operated by a person, firm, or corporation whose business is the furnishing, maintaining, or monitoring of supervised alarm systems. (SIG-SSS)
Proprietary Service

Proprietary System Def.

Remote Station Service
Remote System Def.

Remote Supervising Station Alarm System. A protected premises fire alarm system (exclusive of any connected to a public emergency reporting system) in which alarm, supervisory, or trouble signals are transmitted automatically, recorded in, and supervised from a remote supervising station that has competent and experienced servers and operators who, upon receipt of a signal, take such action as required by this Code. (SIG-SSS)

Supervisory Service is Required

- **Building Code 901.6**
  - Automatic sprinkler systems, except:
    - Systems in one- and two-family dwellings
    - Systems serving less than 20 sprinklers
  - Fire alarm systems, except:
    - Single- and multiple-station smoke alarms
    - Smoke detectors in Group I-3 occupancies
    - Group H fire protection systems per IFC

Fire Alarm and Detection Systems

907.2 Where required

- An approved … shall be provided
  - Manual Fire Alarm System
  - Automatic Fire Detection System
  - Automatic Heat Detection System
- **BUT …**
  - The automatic fire detectors shall be SMOKE DETECTORS.
  - Conditions may dictate other detection methods
### Fire Alarm and Detection Systems

**907.2 Where required**

- Based on OCCUPANCY – look in 907.2
  - Groups listed alphabetically
  - The type of system addresses the needs posed by the occupancy
  - Additional required locations based on special use or occupancy at the end of 907.2

### Student Activity

**Fire Alarm and Detection Systems**

Appendix Page 17 (bottom)

### Student Activity

**In a GROUP F Occupancy**

- When is a system required?
- What type of system is required?
Student Activity

In a GROUP R-1 Occupancy

• When is a system required?
• What type of system is required?

Student Activity

In a GROUP R-2 Occupancy – Student or Staff Housing

• When is a system required?
• What type of system is required?
• Where is it required?

Code Search

• Find the Requirements for SMOKE ALARMS
§ 907.2.10 Single- and Multiple-station Smoke Alarms

- New Construction installation
  - Listed and installed per NFPA 72
- § 907.2.10.1 Where Required
- § 907.2.10.3 Near Cooking Appliances
- § 907.2.10.4 Near Bathrooms

§ 907.2.10 Single- and Multiple-station Smoke Alarms

- § 907.2.10.5 Interconnection
- § 907.2.110.6 Power Source

Summary: Active Fire Protection

- Chapter 9 is Fire Protection Systems
  - Building Code and the Fire Code
- Fire Tetrahedron and the Principles of Combustion
- Alarm and Detection
  - Detect, Notify, Annunciate and Monitor
- 4 basic types of Sprinkler Systems
- 3 Class of Standpipe Systems
- NFPA provides the Referenced Standards
Lesson 8
Recognition of the Fire Service in Fire Safe Design

• A balanced approach to effective protection

In this lesson …

Chapter 3 and 5, Fire Code

• Applicable to all buildings, structures and premises
  – Individual sections specify applicability
  • Addresses such items as:
    – Fire Apparatus Access Roads
    – Premises Identification
    – Key Boxes
    – Hazards to Fire Fighters
    – Fire Protection Water Supplies

§501.1 Scope

§501.1 Scope

Fire service features for buildings, structures and premises shall comply with this chapter.

501.3 Construction documents
501.4 Timing of installation
Fire Apparatus Access Road
Section 503

Definition 202

**FIRE APPARATUS ACCESS ROAD.** A road that provides fire apparatus access from a fire station to a facility, building or portion thereof. This is a general term inclusive of all other terms such as fire lane, public street, private street, parking lot lane and access roadway.

Section 503.1.1

- Required for new and relocated buildings
- Extend to within 150’ “…measured by an approved route around the exterior…”

Section 503.1.1 Exceptions

- 150 feet permitted to be increased where:
  - Building is sprinklered
- Access roads NOT required for:
  - Property conditions prohibits closer access, Building is sprinklered
  - 1.3 Group U
  - 1.4 One and two-family detached dwellings or not more than two Group R-3 occupancies that meet the requirement of Section 511.
SECTION 503
FIRE APPARATUS ACCESS ROADS

503.2 Specifications. Fire apparatus access roads shall be installed and arranged in accordance with Sections 503.2.1 through 503.2.8:

- Dimensions
- Surface
- Dead Ends
- Section 503.2 Increase in Widths

Student Research (Appendix Pg. 18)
Fire Apparatus Access Road (FAAR)

Using 503, find the specifications for:
- Minimum width
- Vertical clearance
- Surface characteristics
- Turning radius
- Dead ends
- Increase Widths?
505 Premises Identification

505.1 Address Identification
- Visible from the street
- 4” high by ½ stroke width for Characters
  Exception: Buildings identified under 911

Title 19 NYCRR Part 1264
Buildings Utilizing Truss Type Construction

Buildings Utilizing Truss-Type Construction
- Identified for responders
- Was effective December 2004
  (you were provided a copy in your 9A class)

1264.1 Introduction. Section 382-a of the Executive Law provides that commercial and industrial buildings and structures that utilize truss type construction shall be marked ...
Identification of Buildings Utilizing Truss Type Construction

- Signs affixed to:
  - Group A, B, E, F, H, I, M, or S occupancy
  - Hotels and motels, Group R-1 or R-2
- Newly constructed buildings
- Existing building where:
  - Addition increases floor area
  - Addition utilizes truss construction

- 6" circle, 1/2" letter stroke
  - Reflective white background
  - Reflective red letters

- Information:
  - Type of Construction
  - Floor, Roof, or Both

Examples
19 NYCRR Part 1264
Identification of Buildings Utilizing Truss Type Construction

- Location details
  - Exterior Doors
    - Entrance, exit and roof access stairways
    - Attached to door, sidelight or adjacent to the door jamb
  - Series of doors
    - At each end
  - Fire Department Connections
  - Specifications:
    - Horizontally within 12"
    - Vertical 42" to 60" above walking surface

19 NYCRR Part 1265 Residential Structures with Truss Type Construction, Pre-Engineered Wood Construction and/or Timber Construction.

- Details
  - Applicability
  - Location of Sign
  - Sign details
  - Notification
  - Enforcement
- Was effective January 1, 2015
  (you were provided a copy in your 9A class)

Fire Protection Water Supply
507 Required water supply

- 507.1 - Shall be provided to premises hereafter constructed …
- 507.2 - Supply MUST be capable of supplying the required fire flow
- 507.3 - “Fire flow” is the amount of water available for firefighting
Fire Protection Water Supply

507.2 Type of Water Supply

- Approved supply consists of:
  - Reservoirs
  - Pressure tanks and Elevated tanks
  - Water mains
  - Other fixed systems capable of providing the required fire flow

- Exception: Allows a Rural Water Supply as provided in NFPA 1142

Fire Protection Water Supply

507.5 Fire Hydrant Systems

- Applicable to "NEW" construction

  Where a location on a newly constructed fire apparatus access road is more than 400 feet (122 m) from a hydrant… on-site fire hydrants and mains shall be provided.

- Exceptions (next slide)

Fire Protection Water Supply

507 Fire Hydrant Systems

- Section 507.5.1 Exceptions:
  - 600 feet allowed for:
    - Group R-3 and U; or
    - Sprinklered Building (regardless of Occupancy)
Fire Command Center Section 508

- Section 508.1 - Where required by other sections ... and in all buildings classified as high-rise
  - Separated by 1-hour fire barrier
  - Minimum size 200 SF *
  - Location approved by the Fire Code Official
  - Comply with NFPA 72
  - Contain the features listed in 508.1.6

Emergency Responder Radio Coverage - Section 510

- Section 510.1:
- New Buildings – approved radio coverage within
  - Based upon existing coverage levels of systems in the jurisdiction
- Existing systems – not required to improve

Emergency Responder Radio Coverage - Section 510

- Section 510.3 through 510.6 Design criteria
  - Permit required to install or modify a system
  - Technical Design Requirements
  - Secondary Power requirements
  - Additional Frequencies

- [NY]511.1 Emergency Vehicle Access
  Detached one or two family dwellings
  One or two Group R-3
  Exceptions:
  - Prior Construction
  - Accessory Structures
  - Dwellings with no electric service


- [NY]511.2 Driveways. Driveways shall be provided when an exit door … is located more than 300 feet (91 440 mm) from a fire apparatus access road …
  - Details and Specifications
    - 12' unobstructed width
    - Turnaround needed if dead end > 500'
    - Turnouts every 500' or less
    - Strength and all weather stability
    - Acceptable grade and turning radius
  - 4 or more Buildings - meet 503.1.1

Summary

- Fire Safe Design relies on Balanced Protection
- Fire Service can respond in ways that equipment cannot
- The code is written to assist and protect the responders as well as the building occupants
Lesson 9

Means of Egress

Means of Egress: History where it came from

Think about as you watch:
- Number of legal exits?
- Where did they go first?
- Occupancy limits?
- What did staff do?
- Problem with Open Staircase?
- Emergency Plans?

Chapter 10

Means of Egress

Determining the Required Number and Width of Exits
Means of Egress

A CONTINUOUS and UNOBSTRUCTED path of vertical and horizontal egress travel from any point in a building or structure to a public way.

Consists of three separate and distinct parts: EXIT ACCESS, EXIT, and EXIT DISCHARGE...

SECTION 1003
GENERAL MEANS OF EGRESS

1003.1 Applicability

... Sections 1003 through 1015 shall apply to all three elements of the means of egress system, in addition to those specific requirements for the exit access, the exit and the exit discharge detailed elsewhere in this chapter.

Chapter 10: Means of Egress
Chapter Numbering

Fundamental Requirements
System design Components

1003 General Means of Egress
1004 Occupant Load
1005 Means of Egress Sizing
1006 Number of Exits and Exit Access Doorways
1007 Exit and Exit Access Doorway Configuration
1008 Means of Egress Illumination
1009 Accessible Means of Egress
1010 Doors, Gates and Turnstiles
1011 Stairways
1012 Ramps
1013 Exit Signs
1014 Handrails
1015 Guards
Chapter 10: Means of Egress

- Additional Sections:
  - 1029 Assembly
  - 1030 Emergency Escape and Rescue
- Chapter ONLY in the Fire Code
  - 1031 Maintenance of the Means of Egress

Job #1: Verification of Exits in New Construction.

Our job is to ensure that a new building has enough exiting for the number of people that will occupy the building.

Step 1) Confirm the DESIGN OCCUPANT LOAD
Step 2) Verify that the proposed WIDTH OF EGRESS COMPONENTS is adequate
Step 3) Ensure that the building provides the required NUMBER OF EXITS (Later in this series)

Determining Occupant Load
**1004 Occupant Load**

**Design Occupant Load 1004.1**

**Step One: 1004.1 Design occupant load.** … the number of occupants … shall be determined in accordance with this section.
- Include all occupants egressing through a space
- Areas without fixed seats use Table 1004.5
- Exception: Actual number when approved

---

**1004 Occupant Load**

**Design Occupant Load 1004**

Where accessory spaces egress through the primary area
- Occupant load is 160 people. Door A is sized to handle that not 150

---

**Design Occupant Load**

**Table 1004.5 (portion)**
### Table 1004.5 (portion)

<table>
<thead>
<tr>
<th>Assembly with fixed seats</th>
<th>See Section 1004.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly without fixed seats</td>
<td></td>
</tr>
<tr>
<td>Concentrated</td>
<td>7 net</td>
</tr>
<tr>
<td>(chairs only—not fixed)</td>
<td></td>
</tr>
<tr>
<td>Standing space</td>
<td>5 net</td>
</tr>
<tr>
<td>Unconcentrated (tables and chairs)</td>
<td>15 net</td>
</tr>
</tbody>
</table>

### 1004.4 Fixed Seating

1004.6 Fixed seating, ... 
determined by the number of fixed seats ... 
- Bleacher type seating
- Booth seating
- Wheelchair Spaces

### Example

- S-2 Warehouse Occupancy
  - 40,000 SF/500 SF per person = 80 people
Student Activity
Appendix Page 19
Determine Design Occupant Load

Retail sales/mercantile

Design Occupant Load = 1,800 / 60 SF per person = 30 people

Office Occupancy

Design Occupant Load = 1,800 / 60 SF per person = 30 people
Design Occupant Load - Answer

1200 SF / 150 SF per person = 8 people

1004 Occupant Load
Increased Occupant Load 1004.5.1

- occupant load ... is permitted to be increased from that number established for the occupancies in Table 1004.5...
  - All other code requirements are met
  - Maximum density one occupant per 7 SF
  - Floor plans (diagrams) may be required

Increased Design Occupant Load

1200 SF / 7 SF per person = 171 people
Increased Design Occupant Load

1200 SF / 7 SF per person = 171 people

Placement of desks becomes important. Egress Must be ensured. Can not get to 171 people.

36 desks have been added, so we now
48 people in this space.

---

Design Occupant Load

Posting of Occupant Load 1004.9

- Every room or space that is an Assembly occupancy
  - Reminder: Accessory rooms or spaces for less than 50 people are considered as part of the primary occupancy
- Conspicuously posted
- Maintained by the Owner

---

System Design Requirements

- 1004.2.3 Adjacent Levels
  - Compute exits for each floor individually
- 1004.4 Multiple Occupancies
  - More stringent requirements apply
- 1005.4 Continuity
  - No reduction allowed in direction of travel
- 1005.6 Egress Convergence
  - Convergence from above and below
  - Sum of the 2 floors
Determining Egress Width

Minimum Egress Width
Section 1005

- Determine the TOTAL WIDTH REQUIRED based on:
  - Occupant load
  - Factors from sections 1005.3.1 and 1005.3.2
- Loss of One Exit shall not reduce capacity more than 50% (in other words… plan ahead)

 Minimum Egress Width 1005
EXIT: Example
S-2 Warehouse Occupancy

40,000 SF/500 SF

What will the doors handle? Divide the door width by 2. 88”/2 = 440 People

40,000 SF
1 story
2 - 44” Doors
No sprinkler system

80 people x .2” per person requires 16inches of door width

Note: 32 inch (door width) measured from the face of the door to the stop. Minimum Size: Section 1010.1.1
Egress Width
1010.1.1 Size of Doors

- Minimum 32" CLEAR WIDTH (with exceptions)
- Measured

Jump Ahead For A Moment!

Minimum Width 50% Rule

OK
The loss of any single exit will not result in the less than ½ of the required width remaining

Reminder: 32 Inch clear width - measured from the face of the door to the stop - Minimum Size Section 1010.1.1

Not permitted
Loss of single exit could result in less than ½ of required width remaining
Minimum Width 50% Rule

OK!
Although double doors give greater than ½ of available width, not less than ½ of required width would still remain.

Egress Width
Section 1005.7.1

Doors opening into the path of egress travel

Egress Width
Section 1005.7.1

- Doors opening into the path of egress travel

7" max. fully opened

40" or 200% required egress width
Two Exits or Exit Access

1007.1.1.1 Arrangement (Remoteness)

- Measurement Point
  - Doorways – measured to any point along the width of the doorway
  - Stairways – measured to the closest riser
  - Ramps – measured to the start of the ramp run

One-Half Diagonal Rule

Exception #2. One-Third if Sprinklered

Student Activity: (Appendix Pg. 20) 1004.2.3 Adjacent Stories, and 1005.6 Egress Convergence

Given:

- 4 Story, Non-sprinklered Office Building
- Occupants exit from each level into enclosure as indicated
- First floor has independent exit without entering stair enclosure
Student Activity

<table>
<thead>
<tr>
<th>Exit Element</th>
<th>Occupant Load Served</th>
<th>Required Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stair A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stair B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stair C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stair D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door E</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Minimum Number of Exits

Exit Access Doorways

**Design Requirements 1006.2.1 Item #1.**

- Are there choices?
  - Each space shall have 2 EXITS or 2 EXIT ACCESS DOORS
  - Table 1006.2.1
Chapter 10
Means of Egress

Fundamental
Requirements and
Components

In this session ... Details

• Design Requirements
  – 1008 Means of Egress Illumination
  – 1009 Accessible Means of Egress
• Exit Components
  – 1010 Doors, Gates and Turnstiles
  – 1011 Stairways
  – 1012 Ramps
  – 1013 Exit Signs
  – 1014 Handrails
  – 1015 Guards

Egress Illumination
Section 1008

• Illuminated at all times that the space is occupied
  – Includes exit discharge
• Emergency Power required as follows:
  – Where 2 means of egress are required
  – Locations
    • Corridors, passageways and aisles
    • Exit stairways and interior discharge elements
    • Discharge areas adjacent to the building
What Is … Emergency Power?

- Types
  - Emergency
  - Standby
- Requirement for Egress Illumination?
  - 90 minute duration
  - Source specified
  - Section [F]604 and the Building Code

Emergency Power Sources

- Unit Equipment
- Storage Battery
- Generator Set
- Uninterruptible Power Supplies

Egress Doors 1010

Egress Component Details

- 1010.1.1 Size of doors
  - Not less than 32" CLEAR
  - Maximum 48" swinging door
  - Hospitals minimum 41.5"
  - 80" height
- 1010.1.2 Door swing
  - Side hinged
  - In direction of egress travel (50 or more people or high-hazard occupancy)
SECTION 1010
DOORS, GATES AND TURNSTILES

1010.1.9 Door operations
- Readily open able without key, tool or special knowledge

1010.1.9.4 Locks and Latches
- Permitted to PREVENT operation of:
  - Detention or restraint
  - Some Main exterior doors
  - Door pair with Automatic Flush Bolts
  - Dwelling or Sleeping Unit
  - Fire Doors

1010.1.9.6 Unlatching
- No more than ONE operation
- Exceptions:
  - Detention or restraint
  - Where manual bolts are allowed (1010.1.9.5)
  - Some Main exterior doors
  - Doors with Automatic Flush Bolts (1010.1.9.4)
  - Dwelling or Sleeping Unit

Hardware Terminology

- Residential additional devices
  - Dead bolt
  - Single vs. double cylinder
  - Night latch
  - Security chain

- Dead Bolts

- Night Latch

- Security Chain
What's Wrong with this Picture?

- Double security lock with inside handle which can be locked from the inside with the turn of a key

What's right with this Picture?

This lock is engineered so a turn of the lever simultaneously retracts both bolt and latch for single operation.

Definitions?
- See 202
- 1010.1.10 Where required:
  - Group A and E with occupant load 50 or more
  - Group H
  - ONLY required on doors with a LOCK OR LATCH
Fire Exit Hardware – you can NOT disable the bar. The door needs to latch. You can still exit but the door latches and seals.

Panic Hardware – you can disable the bar so it can be opened from the outside. Door no longer latches. Purpose is for exiting.

Stairways 1011
Egress Component Details

• Minimum Dimensions
  – Width 44”, or 36” if less than 50 people
  – Width 48” for Accessible Stairways
  – Headroom, 80”
Student Activity (Appendix Pp. 21)

Find the Requirements for Ramps

• In the Appendix record your answers to the following:
  – Maximum Slope
  – Maximum Vertical Rise
  – Minimum Width
  – Minimum Headroom
  – Minimum Dimensions for Landings

Student Activity – Appendix

Find the Requirements for Ramps

– Maximum Slope
– Maximum Vertical Rise
– Minimum Width

– Minimum Headroom
– Minimum Dimensions for Landings

Section 1013 Exit Signs

• Where required
  – Exit and exit access doors
  – Access to exits where direction of travel is not immediately visible
• Located
  – Visible from any direction
  – Within 100’ in an exit access corridor
Section 1013 Exits

- R-1 Occupancies – floor level sign requirements
- Illumination required based on Section 1013.5

What Is an Exit Sign?

§1013.3
- Illumination
  - Internal (1013.5) ; or
  - External (1013.6)
- Tactile Stairway Signs
- Power Source
  - 90 minute emergency power

Student Activity: (Appendix Pg. 21) Exits Signs 1013.1 Where Required

[Diagram of a building layout with indicated rooms and exits]
Student Activity: Appendix
Exits Signs 1013.1 Where Required

Room #1
Room #2
Room #3
Room #4
Room #5

Main Entrance
Rear Exit door

1014 Handrails

1014.1 Where required. Handrails for stairways and ramps shall be:
- Handrail height
- Intermediate handrail
- Graspability
- Continuity
- Handrail extensions
- Clearance
- Projections
- Intermediate rail (stairs)

1015 Guards

- Locations more than 30" above grade
- Not less than 42" high
- Opening limitations
Chapter 10
Means of Egress

- Exit Access, Exit and Exit Discharge
- Public Assembly
- Emergency Escape and Rescue Openings
Exit Access

• Important Topics
  – Are there Alternatives
  – Access Path of Travel
  – Components

1016.2 Intervening Spaces

• Egress SHALL NOT pass through intervening spaces
  – EXCEPT when …
    • Spaces are accessory, AND
    • Not high hazard, AND
    • Discernible path to an exit

• Egress SHALL NOT pass through:
  – Kitchens, storerooms, closets …
  – A room that can be locked to prevent egress
  – Sleeping areas, toilet rooms or bathrooms

1016.2.1 Multiple Tenants

• Egress from …
  – Tenant Space, Dwelling Unit or Sleeping Unit
• Shall not pass through …
  – Adjacent Tenant Space, Dwelling Unit or Sleeping Unit
  – Exception: Means of egress shall not be prohibited through adjoining tenant space where …
Exit Access – Path of Travel
1016.2.1 Multiple Tenants

- **Exception:** Means of egress shall not be prohibited through adjoining tenant space where:
  - Area is < 10% of larger tenant
  - Primarily accessed from the larger tenant space
  - Same or similar occupancy
  - Discernable path of travel
  - Not subject to locking from the egress side
  - Smaller tenant through larger, not the reverse

Exit Access – Path of Travel
Egress Through Adjoining Tenant Space

< 10 %
Access from larger tenant

MAJOR TENANT SPACE
Egress NOT through smaller tenant spaces

< 10 %
Can NOT lock from larger tenant side

Exit Access – Provide Alternatives
Design Requirements 1017

- “Common Path of Egress Travel”
  “That portion of exit access travel distance measured from the most remote point within a story to that point where the occupants have separate access to two exits or exit access doorways.”
Exit Access – Provide Alternatives

Design Requirements 1017.3

Common Path of travel is shown with red arrows

Exit Access Travel Distance

Design Requirements 1017

- 1017.2 Egress Access Travel Distance
- Table 1017.2
- Footnotes allow increase of distance
  - a. Sections which allow modification to travel distance.
  - b. and c. Sprinkler Systems per 903.3.1.1 or 903.3.1.2
  - d. H occupancies with a Sprinkler System in accordance with 903.2.5.1.
  - e. R3 / R4 with conditions

Exit Access – Path of Travel

Travel Distance Measurement

- Section 1017.3
Exit Access – Path of Travel
Travel Distance not exceed Table 1017.2

PARTIAL OF TABLE 1017.2

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>WITHOUT SPRINKLER SYSTEM (FEET)</th>
<th>WITH SPRINKLER SYSTEM (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,E,F-1,M,R,S-1</td>
<td>200</td>
<td>250 b</td>
</tr>
<tr>
<td>I-1</td>
<td>NOT PERMITTED</td>
<td>250 b</td>
</tr>
<tr>
<td>B</td>
<td>300</td>
<td>400 c</td>
</tr>
<tr>
<td>F-2, S-2, U</td>
<td>300</td>
<td>410 c</td>
</tr>
</tbody>
</table>

Aisles
Section 1018

• Serving as a portion of the Exit Access
  – Encroachments - comply with Section 1005.7
  – Serving Assembly Spaces comply with Section 1029
  – In Group B and M Occupancies
    • Per Section 1005.1 for occupant load
    • For corridors per Section 1020.2

Stairways and Ramps

• Exit Access
  – 1019 - Exit Access Stairways and Ramps
• Exit
  – 1023 - Interior Exit Stairways and Ramps

Definition: Exit Access Stairway – stairway within the exit access portion of the means of egress system.

Exit access stairways are not enclosed with Fire Rated construction.
Exit Access Stairway

Exit Access - 1020.1 CORRIDORS

- Shall be rated per Table 1020.1
- Fire Partitions

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>OCCUPANT LOAD DERIVED BY CORRIDOR</th>
<th>REQUIRED FIRE-RESISTANCE RATINGS</th>
<th>MINIMUM RATING</th>
<th>WITH OR WITHOUT</th>
<th>WITH RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-1, H-2, H-3</td>
<td>All</td>
<td>Non-Rated</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>H-4, H-5</td>
<td>Greater than 90</td>
<td>Non-Rated</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>I, J, K, M, N, S-1</td>
<td>Greater than 90</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Greater than 100</td>
<td>Non-Rated</td>
<td>3.75</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>Less than 100</td>
<td>All</td>
<td>Non-Rated</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>All</td>
<td>All</td>
<td>Non-Rated</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Exit Access - 1020.4 Dead End Corridors

Description:
A portion of a corridor in which the travel to an exit is in one direction only.

- Limited to 20' in length with EXCEPTIONS.
Exit Requirements

Exit Definitions
Section 202

Exits include …
- Exterior exit DOORS at grade
- ENCLOSURES for interior stairs and ramps
- Exit PASSAGEWAYS
- EXTERIOR stairs/ramps
- HORIZONTAL exits

Details to follow ....

Building Exit Requirements
Section 1022

• Sections 1022 through 1027
• Applicable sections of Sections 1003 through 1015
• Maintain Level of protection
1022 through 1027
Exits

- Important Topics
  - Sufficient Number
  - Provide a Protected Path of Travel

Minimum Number of Exits
Section 1006.2

- Every Story or occupied roof
- Exit Access Travel Distance exceeded
- Table 1006.2.1

Minimum Number of Exits
Section 1006.2.1.1

- Section 1006.3.2 - Three or More Exits
  - Occupant Load of 501 to 1000 people = 3 Exits
  - Occupant Load over 1000 people = 4 Exits
## 1023 - Interior Stairways and Ramps

**A Protected Path of Travel**

- Interior Stairways and Ramps
- Enclosed by Fire Barriers
  - 4 or more stories, 2 hour rated
  - Less than 4 stories, 1 hour rated
  - The number of stories INCLUDES basements

## 1023.11 SMOKEPROOF Enclosures

**A Protected Path of Travel.**

- Definition from the Building Code
  - *An exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.*
- *Required under Sections 403.5.4 and 405.7.2 and 412.2.2.1*

## 1024 Exit Passageway

**A Protected Path of Travel**

- Minimum width 44”, or 36” if occupant load less than 50
- Minimum 1 hour Fire Barrier enclosure, 2 hour if extending a 2 hour enclosure

Protected Opening  Exit Passageway  Discharge

Minimum 1 hour Fire Barrier
1025 Luminous Egress Path Markings

• Required for high-rise buildings of Group A, B, E, I-1, M or R-1 occupancies
  – Exception – Level of Exit Discharge Lobbies

  • Definition: HIGH-RISE BUILDING. A building with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

1025 Luminous Egress Path Markings

• Markings in Interior Exit Stairs, Ramps and Passageways
  – Steps, landings, and handrails
  – Doors – Emergency Exit Symbol

1026 Horizontal Exits
A Protected Path of Travel

A division of New York Department of State
Stairways and Ramps

- 1023 - Interior Exit Stairways and Ramps
- 1027 - Exterior Exit Stairways and Ramps

A) Interior Exit Stairways and Ramps
- to qualify must be enclosed with a fire-rated enclosure in order to protect the path between the Exit access and the exit discharge.

B) Exterior Exit Stairways and Ramps

1027 Exterior Exit Stairways and Ramps

A Protected Path of Travel

- Not allowed for Group I-2
- Maximum 6 stories, highrise buildings
- Open on at least One Side
  - 35 SF open area
- Protected from Interior Spaces

Exit Discharge
1028 Exit Discharge

The final component of the Means of Egress

- Section 1028.1
- General Rule
  - Exits Discharge
  - Direct to Exterior

1028 Exit Discharge

Not directly to the Exterior

- 1028.1
- Exception #1
  - 50% Rule - Number and Capacity
  - Through level of Discharge

1028 Exit Discharge

Not directly to the Exterior

- 1028.1
- Exception 2
  - 50% Rule - Number and Capacity
  - Through a Vestibule
1028 Exit Discharge

Access to a Public Way

- 1028.5 Access to a Public Way
  - Direct and Unobstructed

- Exception: Safe Dispersal Area
  - At least 5 SF/person
  - On the same property away from the building
  - Not less than 50 feet
  - Permanently maintained and identified
  - Safe path of travel from the building

Assembly Exiting Requirements

1029 Assembly

1029.3 Assembly Other Exits

- Occupant load over 300 people with a main exit
  - Additional exits equal to ½ the occupant load for that level
  - Comply with Section 1007.1

- Multiple main exits or not defined
  - Distributed around the perimeter
  - Must total 100% of required egress
1029 Assembly
1029.6 Means of Egress Width

Clear Width of Aisles and other Means of Egress

- 1029.6.1 Without smoke-protected seating
- 1029.6.2 Smoke-protected seating
- 1029.6.3 Open-air assembly seating

Definition: Smoke Protected Seating

Seating served by means of egress that is not subject to smoke accumulation within or under a structure.

Emergency Escape and Rescue Sections 1030

Definition:

"An operable window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency."

- In ADDITION to the Means of Egress

Emergency Escape and Rescue Requirements
Emergency Escape and Rescue
Sections 1030.1 and 1030.2

• Group R-2 and
  Group R-3 and R-4 Occupancies
• Basements and sleeping rooms below the 4th floor
• Basements with sleeping rooms
  – With exceptions with conditions

Summary
Chapter 10 Means of Egress

• Design Occupant Load
  – Square Footage
• Sufficient Exit Width
• Minimum Number of Exits
• 3 Components
  – Exit Access
  – Exit
  – Exit Discharge
Lesson 10
Accessibility

Chapter 11
• Accessibility

Issues and Concerns:
• Chapter 11 of the 2020 BCNYS
• ICC- A117.1-2009
• 2020 EBCNY
• Americans With Disability Act
Definitions

ACCESSIBLE. A site, building, facility or portion thereof that complies with Chapter 11.

ACCESSIBLE MEANS OF EGRESS. A continuous and unobstructed way of egress travel from any accessible point in a building or facility to a public way.

ACCESSIBLE UNIT. A dwelling unit or sleeping unit that complies with this code and the provisions for Accessible units in ICC A117.1.
Definitions

TYPE A UNIT. A dwelling unit or sleeping unit designed and constructed for accessibility in accordance with this code and the provisions for Type A units in ICC A117.1.

ACCESSIBILITY

1103.1 Where required. Sites, buildings, structures, facilities, elements and spaces, temporary or permanent, shall be accessible to individuals with disabilities.

• With some General Exceptions
WHAT IS THE ADA?
Legislation Signing in 1990
AND WHO DOES ENFORCEMENT?

Pizza Man Pete

Accessibility
Chapter 11 of the Building Code
Establishes what and when
ICC A117.1-2009
Provides the Accessibility Details
2020 EBCNYS Section 305

305.1 Scope. The provisions of Sections 305.1 through 305.9 apply to maintenance, change of occupancy, additions and alterations to existing buildings, including those identified as historic buildings.

Section 305.2

305.2 Maintenance of facilities. A facility that is constructed or altered to be accessible shall be maintained accessible during occupancy.
### Section 305

#### 305.4 Change of Occupancy

Existing buildings that undergo a change of group or occupancy shall comply with this section.

#### 305.5 Additions

Provisions for new construction shall apply to additions. An addition that affects the accessibility to, or contains an area of, primary function shall comply with the requirements in Section 305.7.

#### 305.6 Alterations

A facility that is altered shall comply with the applicable provisions in Chapter 11 of the Building Code of New York State, unless technically infeasible. Where compliance with this section is technically infeasible, the alteration shall provide access to the maximum extent that is technically feasible.

**Exceptions:**
Section 305

305.7 Alterations affecting an area of primary function. Where an alteration affects the accessibility to, or contains an area of primary function, the route to the primary function area shall be accessible. The accessible route to the primary function area shall include toilet facilities and drinking fountains serving the area of primary function.

Exceptions:

Section 305

305.8 Scoping for alterations. The provisions of Sections 305.8.1 through 305.8.15 shall apply to alterations to existing buildings and facilities.

Section 1508

1508.1 Construction sites. Structures, sites, and equipment directly associated with the actual process of construction, including but not limited to scaffolding, bridging, material hoists, material storage, or construction trailers are not required to be accessible.