1

Goal

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

2

Objectives

Upon completion, participants will be better able to:

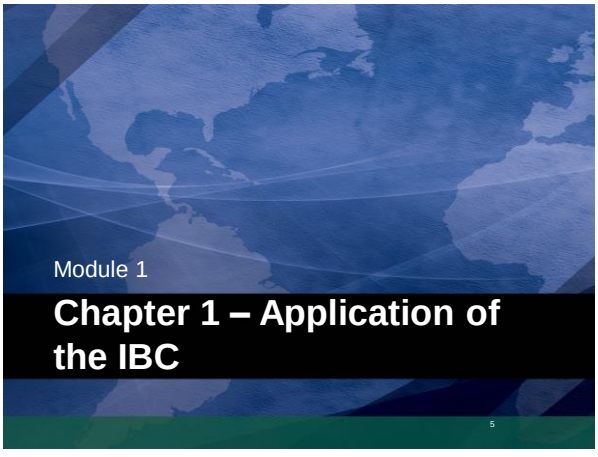
1. Classify uses into occupancy groups.
2. Determine the type of construction of a proposed building.
3. Calculate actual and allowable building height and floor area.
4. Identify required fire-resistance-rated assemblies.
5. Determine interior finish requirements.
6. Identify any fire protection systems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

3

Overview

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

4



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Scope/Applicability Provisions

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

6

Effective Use of the IBC

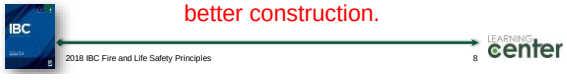
- The following procedure is suggested:
  - Building Classification
  - Fire Protection Systems
  - Means of Egress
  - Fire and Smoke Protection Features
  - Interior Finishes
  - Special Detailed Requirements Based on Use and Occupancy
  - Additional Applicable Provisions

7

Administration

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

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



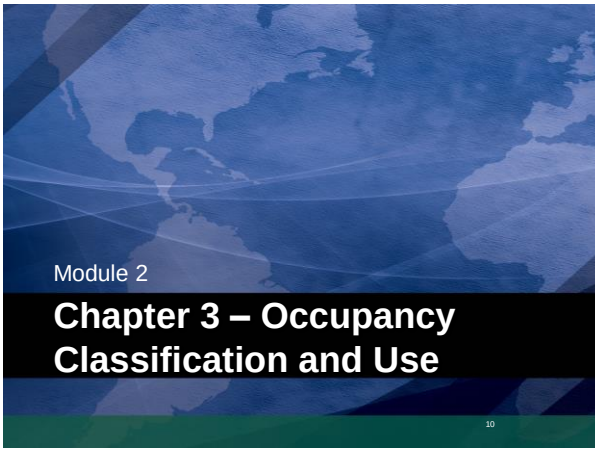
8

Administration

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

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

9



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Occupancy Classification

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

11

Occupancy Classification

To achieve equivalent safety in building design, each occupancy group and division varies by:

- Type of construction restrictions.
- Fire protection requirements.
- Location, area and height limitations.
- Means of egress elements.

12

Occupancy Classification

Occupant-related Hazards

- Number of occupants.
- Density of the occupants.
- Age of the occupants.
- Mobility of the occupants.
- Awareness of the occupants.

13

Occupancy Classification

Content-related Hazards

- Density of contents.
- Quantity of contents.
- Type of contents.
- Environment of contents.
- Flammability of contents.

14

Occupancy Classification Section 302.1

- A — Assembly.
- B — Business.
- E — Educational.
- F — Factory and Industrial.
- H — Hazardous.
- I — Institutional.
- M — Mercantile.
- R — Residential.
- S — Storage.
- U — Utility and Miscellaneous.

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Occupancy Classification Sections 303-305

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

16

Occupancy Classification Sections 306-307

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

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Occupancy Classification Sections 308-309

- 308.1 - Institutional Group I
  - Group I-1 (Conditions 1 and 2)
  - Group I-2 (Conditions 1 and 2)
  - Group I-3
  - Group I-4
- 309.1 – Mercantile Group M

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Occupancy Classification Sections 310-312

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

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1. Cell Phone Tower

20

2. Insurance Office

21

3. Steel Fabrication Plant

22

4. Local Grade School

23

5. Hospital

24

6. Bank

25

7. Juvenile Detention Center

26

8. Oil and Lube Shop

27

ACTIVITY

9. Convenience Store

28

ACTIVITY

10. Multiplex Theater

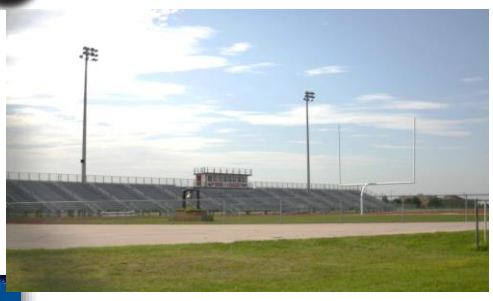
29

ACTIVITY

11. Canopy Over Pump Island

30

12. Bleachers at Football Field



31

13. Auto Body Shop

32

14. Open Parking Garage

33

What information is required to properly classify the following?

15. Kitchen Serving a Restaurant

34

What information is required to properly classify the following?

16. Boarding House

35

What information is required to properly classify the following?

17. Facility Used to Care for Children

36

What information is required to properly classify the following?

18. Dance Studio for Children

37

What information is required to properly classify the following?

19. Private Garages for Condominiums

38

What information is required to properly classify the following?

20. Self-storage Facility

39

What information is required to properly classify the following?

21. Dental Office

40

What information is required to properly classify the following?

22. Casino Gaming Area

41

What information is required to properly classify the following?

23. Fast Food Carry-out

42

ACTIVITY

What information is required to properly classify the following?

24. Assisted Living Facility

43

Chapter 6 – Types of Construction

Module 3

44

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Types of Construction

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

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Types of Construction

Material	Structural Elements	Construction Types
Noncombustible	Exterior and interior (bearing or nonbearing) walls, floors, roofs, and structural elements to be of noncombustible materials	IBA IIA IIB
Combustible and/or noncombustible	Exterior walls to be of noncombustible materials	IIIA IIIB IV VA VB

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REFER TO CODE BOOK

Table 601

2018 IBC
Table 601
Page 119

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame[g] (see Section 202)	3[a, b]	2[a, b]	1[b]	0	1[b]	0	HT	1[b]	0
Bearing walls Exterior[e, f] Interior	3 3[b]	2 2[b]	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2[b, c]	1[b, c]	1[b, c]	0[c]	1[b, c]	0	HT	1[b, c]	0

For SI: 1 foot = 304.8 mm.
a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed where a 1-hour or less fire-resistance rating is required.
d. Not less than the fire-resistance rating required by other sections of this code.
e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).
f. Not less than the fire-resistance ratine as referenced in Section 704.10.

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Table 601 Notes

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

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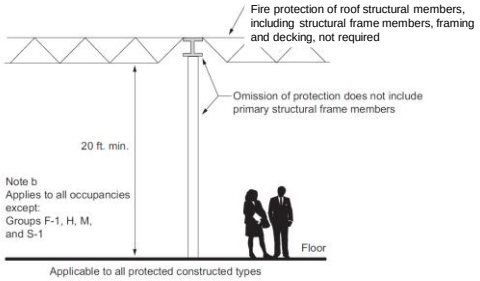
Types of Construction
Table 601, Note b



For SI: 1 foot = 304.8 mm.

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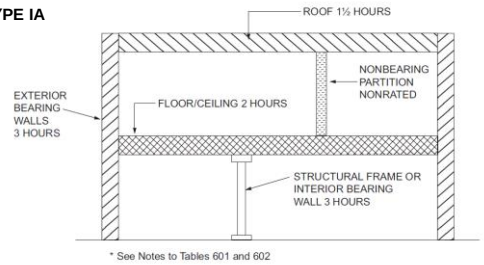
Type I Construction

TYPE IA



* See Notes to Tables 601 and 602

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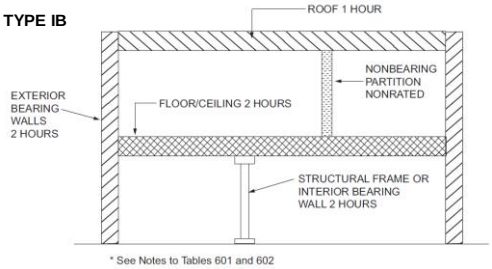
Type I Construction

TYPE IB



* See Notes to Tables 601 and 602

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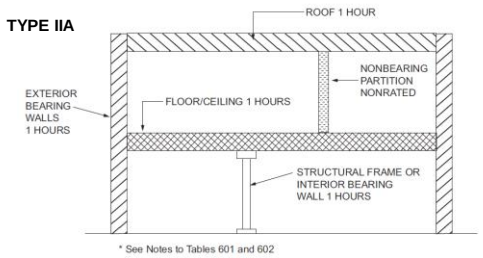
Type II Construction



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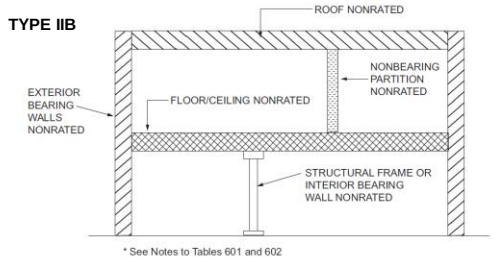
Type II Construction



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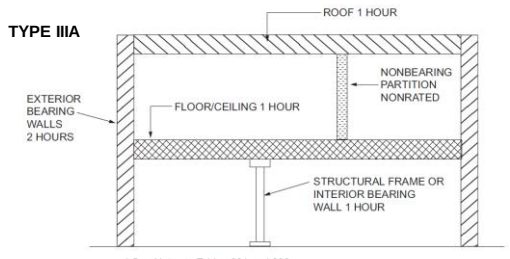
Types of Construction



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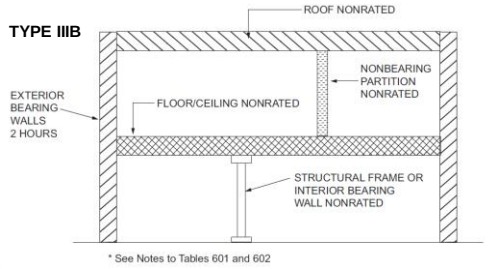
Type III Construction



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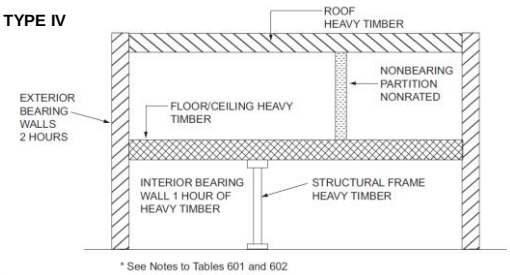
Type IV Construction



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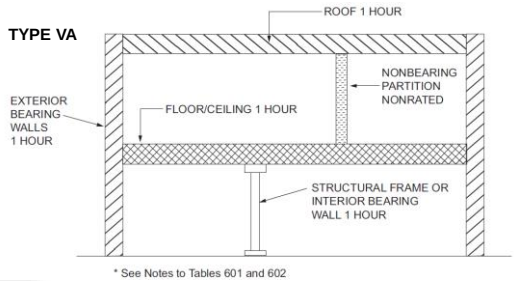
Type V Construction



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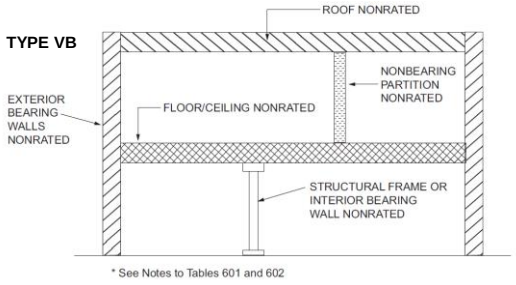
Type V Construction



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REFER TO CODE BOOK

Table 602

2018 IBC Table 602 Page 120

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, c, e]

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[d]	OCCUPANCY GROUP F-1, M, S-1[f]	OCCUPANCY GROUP A, B, E, F-2, I, R[f], S-2, U[b]
X < 5[g]	All	3	2	1
5 ≤ X < 10	IA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB	2	1	1[h]
	IIB, VB	1	0	0
	Others	1	1	1[h]
X ≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.
a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
b. See Section 706.1.1 for party walls.
c. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
d. The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
e. For special requirements for Group H occupancies, see Section 415.6.
f. For special requirements for Group S aircraft hangars, see Section 412.3.1.
g. Where Table 705.8 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.
h. For a building containing only a Group U occupancy private garage or carport, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.
i. For a Group R-3 building of Type II-B or Type V-B construction, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.

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Section 603 – Combustible Material in Type I and Type II Construction

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

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Section 603 – Combustible Material in Type I and Type II Construction

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

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Special Detailed Requirements

- 402 – Covered mall and open mall buildings
- 403 – High-rise buildings
- 404 – Atriums
- 405 – Underground buildings
- 406 – Motor-vehicle-related occupancies
- 407 – Group I-2
- 408 – Group I-3

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Special Detailed Requirements

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

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Special Detailed Requirements

- 415 – Groups H-1, H-2, H-3, H-4 and H-5
- 416 – Spray application of flammable finishes
- 417 – Drying rooms
- 418 – Organic coatings
- 419 – Live/work units
- 420 – Groups I-1, R-1, R-2, R-3 and R-4

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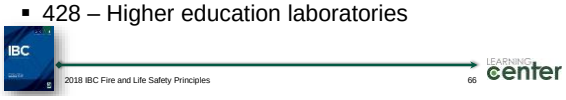
Special Detailed Requirements

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



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Special Detailed Requirements Based on Use and Occupancy

1. What is the purpose of a control area?

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

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Special Detailed Requirements Based on Use and Occupancy

2. How must individual dwelling units be separated from other areas of an apartment building?

Section 420. Dwelling units must be separated from each other and from other occupancies in the building through the use of fire partitions and/or horizontal assemblies.

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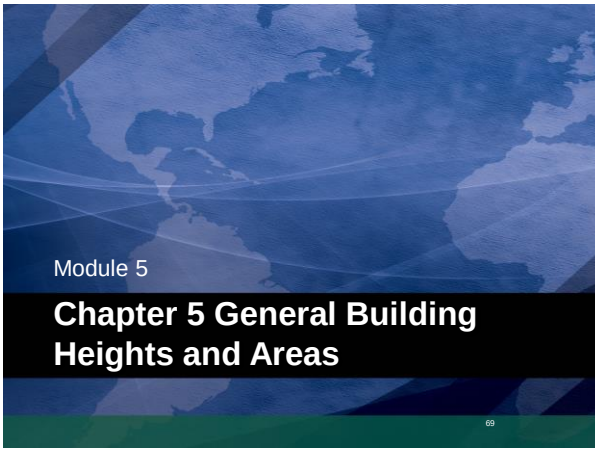

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Allowable Area

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

70

Area Limitations

- The restrictions for maximum building area are intended to limit the size of the fire that potentially may develop.
- Primary concern is that of property damage and spread of fire to adjacent buildings.

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Area Limitations

- Life safety is considered because of the number of occupants.
- Fire fighting accessibility and protection of fire department personnel is a factor.

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Area Limitations

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

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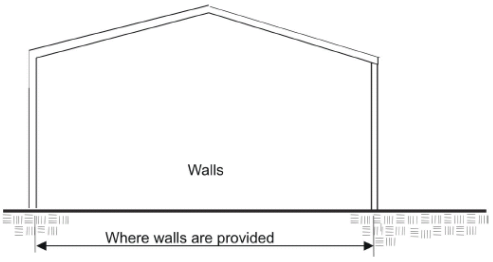
Section 503 – General Height and Area Limitations



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Section 503.1.2 – Buildings on the Same Lot

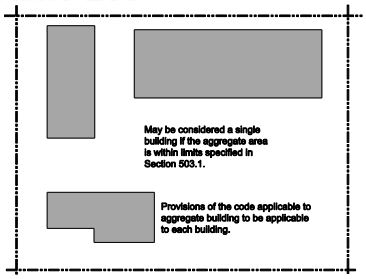

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Table 504.3 – Building Height

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S									
H-4	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85						
I-4	NS[d, g]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
R[h]	NS[g]	UL	160	65	55	65	55	65	50	40
	S13D	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	85	70	60

For SI: 1 foot = 304.8 mm.

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Table 504.3 – zoom to B

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60

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Table 504.4 – Building Height in Stories Above Grade Plane

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	2	1
	S	UL	6	4	3	4	3	4	3	2
A-2	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-3	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-4	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	3	2
	S	UL	12	6	4	6	4	6	4	3
E	NS	UL	5	3	2	3	2	3	1	1
	S	UL	6	4	3	4	3	4	2	2
F-1	NS	UL	11	4	2	3	2	4	2	1
	S	UL	12	5	3	4	3	5	3	2
F-2	NS	UL	11	5	3	4	3	5	3	2

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Table 504.4 – zoom into B

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
B	NS	UL	11	5	3	5	3	5	3	2
	S	UL	12	6	4	6	4	6	4	3

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Table 506.2

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-5	NS									
	S1	UL	UL	UL	UL	UL	UL	UL	UL	UL
	SM									
B	NS	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	102,000	74,000	38,000

80

Table 506.2 zoom to B

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
B	NS	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	108,000	54,000	27,000

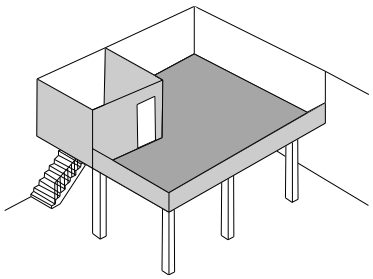
81

Section 505 – Mezzanines

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

82

Section 505.2.3 – Mezzanine Openness



83

Section 506 – Building Area

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

84

Table 506.2 – Allowable Area Factor

TABLE 506.2
ALLOWABLE AREA FACTOR (A = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S1									
	SM									
B	NS	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	76,500	55,500	28,500

85

Section 506.2 – Allowable Area Determination

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

86

Section 506.3 – Frontage Increase

The following apply to an area increase for frontage:

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

87

Section 506.3 – Frontage Increase

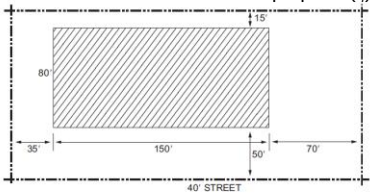
- The following formula is to be used in determining the area increase due to frontage.

$$I_f = [F/P - 0.25]W/30$$

88

Section 506.3 – Frontage Increase

- **Example 1 of Area Increase for Frontage**
- **Given:** Yards as shown, 40-foot (12 192 mm) street
- **Determine:** Percent increase for area purpose (I_f)



For SI: 1 foot = 304.8 mm.

89

Section 506.3 – Frontage Increase

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

$F = 310'$
$P = 460'$
$W = 35', 70', 90'$

$$\left[\frac{310}{460} - 0.25\right]\frac{30^*}{30}$$

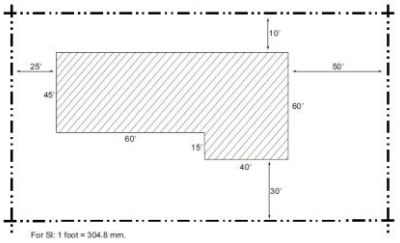
[0.67 - 0.25] 1.0
[0.42] 1.0
$I_f = 0.42$

*[where W exceeds 30 feet (9144 mm), a value of 30 feet (9144 mm) is to be used]

90

Allowable Area Calculation

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



91

Allowable Area Activity

Determine: Maximum allowable area for the building (A_a)

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

A_t = 69,000 square feet (6410 m^2) (Table 506.2)

NS = 23,000 square feet (2137 m^2)

$I_f = \left[\frac{220}{320} - 0.25\right]\frac{29^*}{30} = [0.69 - 0.25]0.96 = 0.42$ (*based on weighted average)

$S_a = 3$

A_a = 69,000 + [23,000(0.42)] × 3

= [69,000 + 9,660] × 3

= 78,660 square (7308 m^2) feet per story × 3

= 235,980 square feet (21 923 m^2) for building

92

Section 507 – Unlimited Area Buildings

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

93

REFER TO CODE BOOK

2018 IBC
Table 509
Page 116

Table 509 – Incidental Uses

[F] TABLE 509
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Stationary storage battery systems having an energy capacity greater than the threshold quantity specified in Table 1206.2 of the *International Fire Code*	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation requirements.

For SI: 1 square foot = 0.0929 m², 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m³.

94

Section 508 – Mixed Occupancies

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

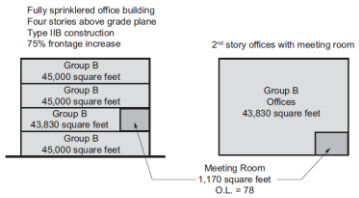
95

Section 508.2 – Accessory Occupancies

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

96

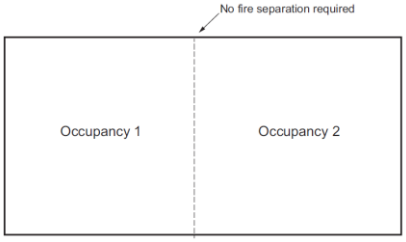
Section 508.2 – Accessory Occupancies



For SI: 1 square foot = 0.0929 m².

97

Section 508.3 – Nonseparated Occupancies



98

Nonseparated Occupancies

For SI: 1 square foot =0.0929 m².

99

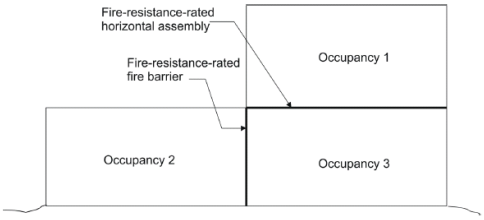
Solution: Nonseparated Occupancies

Occupancy	Allowable Height (stories)	Allowable Area (square feet)	Sprinkler System	Fire Alarm System
Group A-2	3	28,500	Yes	??
Group B	4	69,000	No	Yes
Group M	3	37,500	Yes	??

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

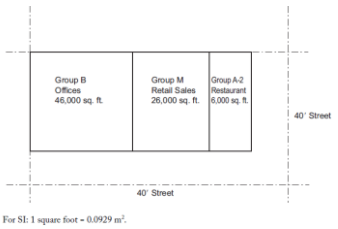
100

Section 508.4 – Separated Occupancies



101

Separated Occupancies



For SI: 1 square foot = 0.0929 m².

102

Solution: Separated Occupancies

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

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

Occupancy	Tabular Area (square feet)	Frontage Increase (square feet)	Allowable Area (square feet)
Group A-2	38,000	2,375	40,375
Group B	92,000	5,750	97,750
Group M	50,000	3,125	53,125

$6{,}000/40{,}375 + 46{,}000/97{,}750 + 26{,}000/53{,}125 \leq 1.0$???

$0.15 + 0.47 + 0.49 \leq 1.0$???

$1.11 > 1.0$, therefore, building does not comply as a separated occupancies building.

103

Section 510 Special Provisions

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

104

105

Chapter 7

This chapter contains provisions for building elements and protection features such as:

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

106

Fire-Resistance Ratings and Fire Tests

The code distinguishes between two fundamental types of ratings for these assemblies:

- Fire resistance.
- Fire protection.

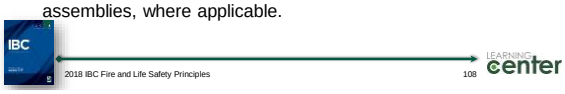
Collectively, they provide *fire-resistant construction*.

107

Fire-Resistance Ratings and Fire Tests

For the specified hourly rating, the conditions of acceptance for walls ensure that the assemblies will at least:

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



108

Fire-Resistance Ratings and Fire Tests

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

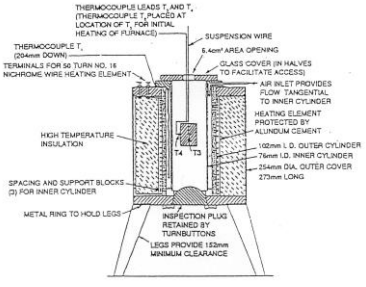
109

Section 703.2 – Fire-resistance Ratings
Section 703.3 – Methods for Determining Fire-resistance

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

110

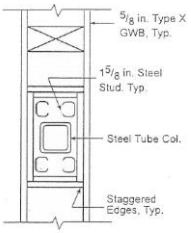
Section 703.5 – Noncombustibility Tests



111

Fire and Smoke Protection Features

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

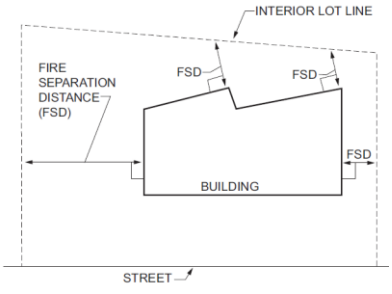


TYPE VA

For SI: 1 inch = 25.4 mm

112

Section 705 – Exterior Walls



113

Section 705.2 – Projections

2018 IBC Table 705.2, page 126

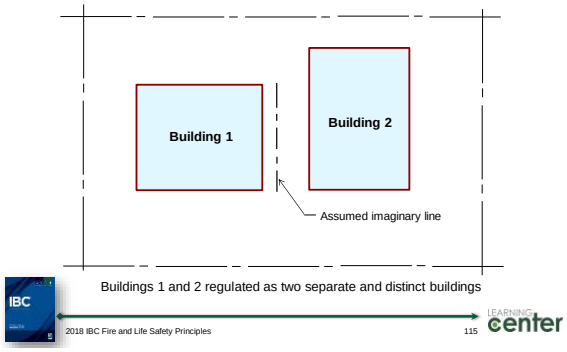
TABLE 705.2
MINIMUM DISTANCE OF PROJECTION

FIRE SEPARATION DISTANCE-FSD (feet)	MINIMUM DISTANCE FROM LINE USED TO DETERMINE FSD
0 to less than 2	Projections not permitted
2 to less than 3	24 inches
3 to less than 5	24 inches plus 8 inches for every foot of FSD beyond 3 feet or fraction thereof
5 or greater	40 inches

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm.

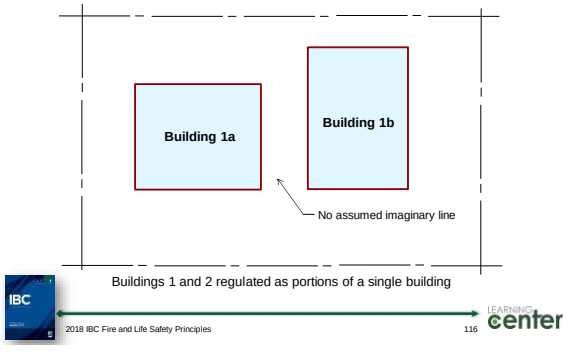
114

Section 705.3 – Buildings on the Same Lot



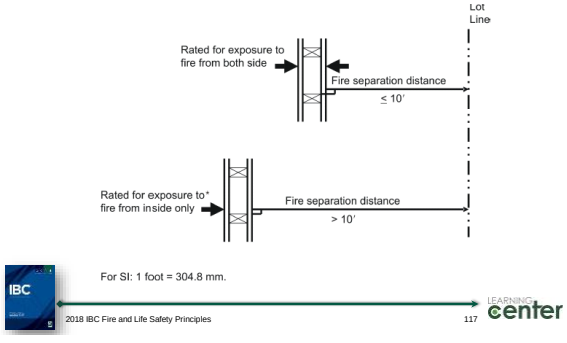
115

Section 705.3 – Buildings on the Same Lot



116

Section 705.5 – Fire-resistance Ratings



117

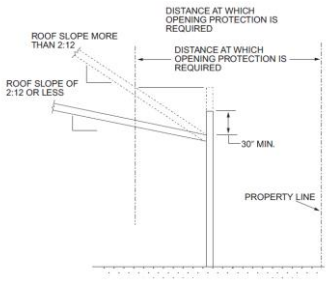
Section 705.8 Maximum Area of Exterior Wall Openings

TABLE 705.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON
FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION

FIRE SEPARATION DISTANCE (feet)	DEGREE OF OPENING PROTECTION	ALLOWABLE AREA[a]
0 to less than 3[b, c, k]	Unprotected, Nonsprinklered (UP, NS)	Not Permitted[k]
	Unprotected, Sprinklered (UP, S)[i]	Not Permitted[k]
	Protected (P)	Not Permitted[k]
3 to less than 5[d, e]	Unprotected, Nonsprinklered (UP, NS)	Not Permitted
	Unprotected, Sprinklered (UP, S)[i]	15%
	Protected (P)	15%
5 to less than 10[e, f, j]	Unprotected, Nonsprinklered (UP, NS)	10%[k]
	Unprotected, Sprinklered (UP, S)[i]	25%
	Protected (P)	25%
10 to less than 15[b, f, g, j]	Unprotected, Nonsprinklered (UP, NS)	15%[k]
	Unprotected, Sprinklered (UP, S)[i]	45%
	Protected (P)	45%

118

Section 705.11 – Parapets

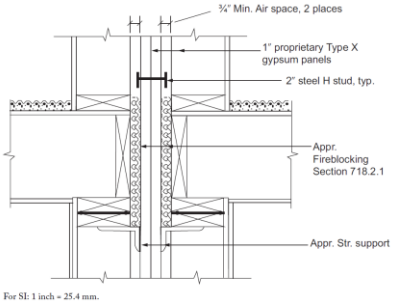


For SI: 1 inch = 25.4 mm.

For SI: 1 inch = 25.4 mm.

119

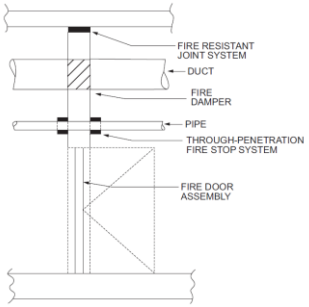
Section 706 – Fire Walls



For SI: 1 inch = 25.4 mm.

120

Section 707 – Fire Barriers



121

Section 708 – Fire Partitions

It is limited in scope to the following required locations:

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

122

Section 709 – Smoke Barriers

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

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

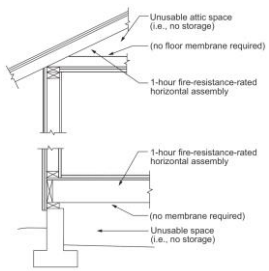
123

Section 710 – Smoke Partitions

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

124

Section 711 – Horizontal Assemblies

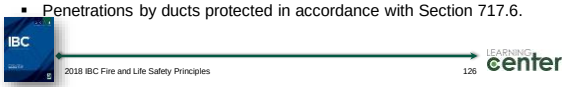


125

712 – Vertical Openings

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

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



126

Section 712 – Vertical Openings

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

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

127

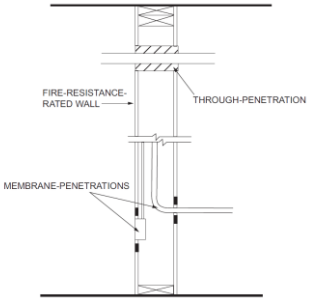
Section 713 – Shaft Enclosures

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

128

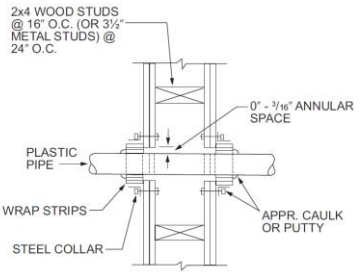
Section 714 – Penetrations

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



129

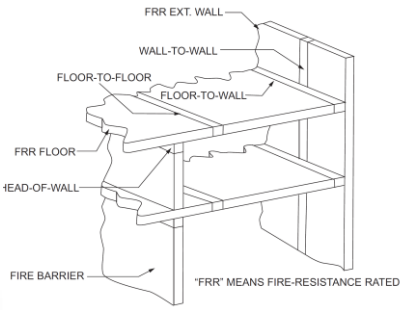
Section 714 – Penetrations



For SI: 1 inch = 25.4 mm.

130

Section 715 – Joint Systems



131

Section 716 – Opening Protectives

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

132

REFER TO CODE BOOK

2018 IBC
Table 716.1(2)
Pages 146-147

Table 716.1(2) – Fire Door and Fire Shutter Assemblies

TABLE 716.1(2)—continued
OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE[a]	FIRE-RATED GLAZING MARKING DOOR VISION PANEL[c, e]	MINIMUM SIDELIGHT/ TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELIGHT/ TRANSOM PANEL	
					Fire protection	Fire resistance	Fire protection	Fire resistance
Exterior walls	3	1½	100 sq. in.[b]	≤ 100 sq. in. = D-H-90 > 100 sq. in = D-H-W-90	Not Permitted	3	Not Permitted	W-180
	2	1½	Maximum size tested	D-H 90 or D-H-W-90	1½	2	D-H-OH-90	W-120
					Fire protection			
	1	¾	Maximum size tested	D-H-45	¾		D-H-45	
					Fire protection			
Smoke barriers	1	⅓	Maximum size tested	D-20	⅔		D-H-OH-45	

For SI: 1 square inch = 645.2 mm.
a. Two doors, each with a fire protection rating of 1½ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.
b. Fire-resistance-rated glazing tested to ASTM E119 in accordance with Section 716.1.2.3 shall be permitted, in the maximum size tested.
c. Under the column heading "Fire-rated glazing marking door vision panel," W refers to the fire-resistance rating of the glazing, not the frame.
d. See Section 716.2.5.1.2.1.
e. See Section 716.1.2.2.1 and Table 716.1(1) for additional permitted markings.

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REFER TO CODE BOOK

2018 IBC
Table 716.1(3)
Page 150

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

TABLE 716.1(3)
FIRE WINDOW ASSEMBLY FIRE PROTECTION RATINGS

TYPE OF WALL ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE WINDOW ASSEMBLY RATING (hours)	FIRE-RATED GLAZING MARKING
Interior walls			
Fire walls	All	NP[a]	W-XXX[b]
Fire barriers	>1	NP[a]	W-XXX[b]
	1	NP[a]	W-XXX[b]
Atrium separations (Section 707.3.6), Incidental use areas (Section 707.3.7), Mixed occupancy separations (Section 707.3.9)	1	¾	OH-45 or W-60
Fire partitions	1	¾	OH-45 or W-60
	0.5	½	OH-20 or W-30
Smoke barriers	1	¾	OH-45 or W-60
Exterior walls	>1	1½	OH-90 or W-XXX[b]
	1	¾	OH-45 or W-60
	0.5	½	OH-20 or W-30
Party wall	All	NP	Not Applicable

NP = Not Permitted.
a. Not permitted except fire-resistance-rated glazing assemblies tested to ASTM E119 or UL 263, as specified in Section 716.1.2.3.
b. XXX = The fire rating duration period in minutes, which shall be equal to the fire-resistance rating required for the wall assembly.

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REFER TO CODE BOOK

2018 IBC
Table 717.3.2.1
Page 151

Section 717 – Ducts and Air Transfer Openings

TABLE 717.3.2.1
FIRE DAMPER RATING

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hours)
Less than 3-hour fire-resistance-rated assemblies	1.5
3-hour or greater fire-resistance-rated assemblies	3

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Fire-resistance-rated construction

Wall assembly	Fire door assembly
D 1-hour interior exit stairway	A. No rating required
F 3-hour fire wall	B. 20 minutes
C 1-hour occupancy separation	C. 45 minutes
E 2-hour fire area separation	D. 1 hour
A Smoke partition	E. 1 1/2 hours
B Smoke barrier	F. 3 hours

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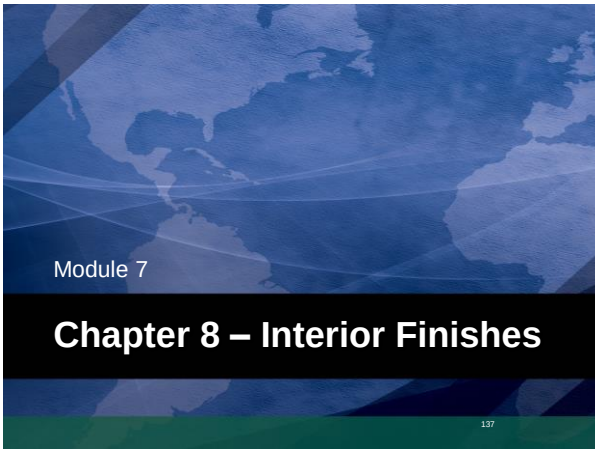

137

Section 803 – Wall and Ceiling Finishes

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

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

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Section 803 – Wall and Ceiling Finishes

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

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

139

Section 803.13 – Interior Finish Requirements Based on Groups

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

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

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Section 803.13 – Interior Finish Requirements Based on Groups

TABLE 803.13
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY[a]

GROUP	SPRINKLERED			NONSPRINKLERED		
	Interior exit stairways and ramps and exit passageways[a, b]	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces[c]	Interior exit stairways and ramps and exit passageways[a, b]	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces[c]
A-1 & A-2	B	B	C	A	A[d]	B[d]
A-3[e], A-4, A-5	B	B	C	A	A[d]	C
B, E, M, R-1	B	C[m]	C	A	B	C
R-4	B	C	C	A	B	B
F	C	C	C	B	C	C
H	B	B	C[g]	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B[h, i]	A	A	B
I-3	A	A[j]	C	A	A	B
I-4	B	B	B[h, i]	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

(Footnotes a through m not shown)

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Section 804 – Interior Floor Finish Requirements

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

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General Requirements for Fire Protection Systems

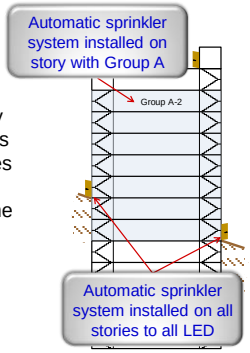
- Fire protection systems are to be installed, repaired, operated and maintained in accordance with the IBC and the IFC.
- Systems not required by the IBC are permitted to be installed for partial or complete protection, provided such systems meet the requirements of the IBC.
- Any system for which an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

144

Fire Sprinklers in Group A

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

§903.2.1.1, 903.2.1.2, 903.2.1.3, 903.2.1.4.



145

Group A-1 §903.2.1.1

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

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Group A-2 §903.2.1.2

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

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Group A-3 & A-4 §903.2.1.3, §903.2.1.4

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

IBC 148 LEARNING center

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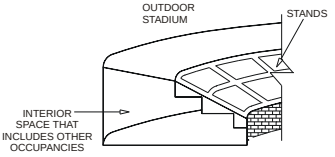
Group A-5 §903.2.1.5

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



IBC 149 LEARNING center

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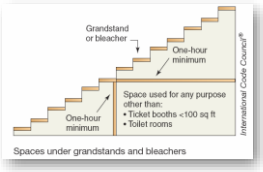
Group A-5 §903.2.1.5.1

- **903.2.1.5.1 Spaces under grandstands or bleachers.**
- Enclosed spaces under *grandstands* or *bleachers* shall be equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1 where either of the following exist:
- 1. The enclosed area is 1,000 square feet (93 m2) or less and is not constructed in accordance with Section 1029.1.1.1.
- 2. The enclosed area exceeds 1,000 square feet (93 m2).

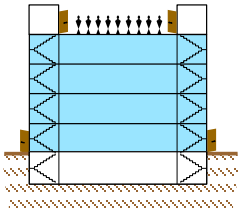


IBC 150 LEARNING center

150

Assembly Occupancies on Roofs §903.2.1.6

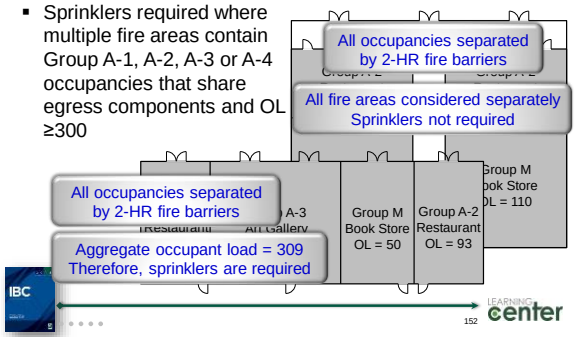
- Fire sprinklers are required on all floors between an occupied roof and the LED discharge where assembly uses occur on the rooftop and:
  - OL >100 for Group A-2, or
  - OL >300 for other Group A occupancies



151

Multiple Group A Fire Areas §903.2.1.7

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



152

Ambulatory Care Facilities §903.2.2

How do you determine the number of care recipients?

Count the beds

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

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

153

Ambulatory Care Facilities §903.2.2

- In buildings where ambulatory care is provided on levels other than the *level of exit discharge*, an *automatic sprinkler system* shall be installed throughout the entire floor as well as all floors below where such care is provided, and all floors between the level of ambulatory care and the nearest *level of exit discharge*, the *level of exit* discharge, and all floors below the *level of exit discharge*.
- **Exception:** Floors classified as an open parking garage are not required to be sprinklered.

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Group E §903.2.3

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

155

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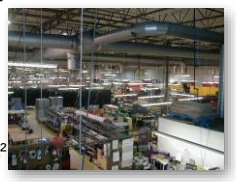
Group F-1 §903.2.4

- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area is >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for manufacture of upholstered furniture or mattresses >2,500 ft²



156

156

Woodworking Operations §903.2.4.1

- Fire sprinklers required throughout the building where ***both*** of the following conditions exist:
  - Fire area >2,500 ft²
  - The process generates finely divided waste or uses finely divided combustible material

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Group H §903.2.5

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

- Flammable & combustible liquids
- Flammable & pyrophoric gases
- Level 2 & 3 aerosols
- Organic peroxides
- Oxidizers

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Group H-5 §903.2.5.2

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

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Group I
§903.2.6

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

160

Group M
§903.2.7

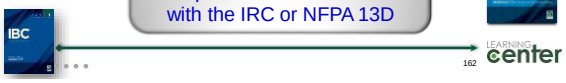
- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for display and sale of upholstered furniture or mattresses >5,000 ft²

161

Group R
§903.2.8

- Fire sprinklers required throughout the building for all Group I occupancies
- NFPA 13D systems in Group R-3, R-4 Condition 1 and care facilities with ≤5 clients
- NFPA 13R systems in Group R-4 Condition 2
- §903.3.2 requires the installation of QR or residenti… and sleeping…

1- & 2-family dwellings and townhomes built under the IRC are sprinklered in accordance with the IRC or NFPA 13D



162

Pedestal/Podium Construction IBC §510.4

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

IBC 163 LEARNING center

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Pedestal/Podium Construction

IBC 164 LEARNING center

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Pedestal/Podium Construction

IBC 165 LEARNING center

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Group S-1 §903.2.9

- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area is >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for storage of upholstered furniture or mattresses >2,500 ft²
  - The storage of commercial trucks or buses when the fire area is >5,000 ft²

166 LEARNING center

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Group S-1 Repair Garages §903.2.9.1

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

167 LEARNING center

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Group S-1 Storage of Tires §903.2.9.2

- Fire sprinklers required when:
  - Fire area >20,000 cubic feet

Would this be considered high-piled combustible storage?

168 LEARNING center

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Group S-2 Enclosed Parking Garage §903.2.10

- Fire sprinklers required when :
  - Fire area >12,000 ft²
  - Parking garage is located beneath another occupancy

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Section 901.7 – Fire Areas

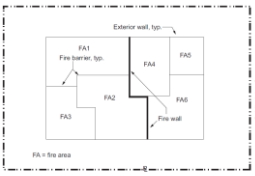

TABLE 707.3.10
FIRE-RESISTANCE RATING REQUIREMENTS FOR FIRE BARRIERS, FIRE WALLS OR HORIZONTAL ASSEMBLIES BETWEEN FIRE AREAS

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, M, R, S-2	2
U	1

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Section 903 – Automatic Sprinkler Systems

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

- Group H-5
- Group I
- Group R

An automatic sprinkler system is required throughout the occupancy for the following occupancies:

- Groups H-1, H-2, H-3 and H-4

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Section 903 – Automatic Sprinkler Systems

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

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

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Section 903 – Automatic Sprinkler Systems

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

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

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Section 903 – Automatic Sprinkler Systems

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

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

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Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required:

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

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Application Matrix of the NFPA Sprinkler Standards

NFPA Standard Design Consideration	NFPA Sprinkler Standard		
	NFPA 13	NFPA 13R	NFPA 13D (IRC P2904)
Extent of Protection	Throughout the building (IFC Section 903.3.1.1)	Occupied spaces (IFC Section 903.3.1.2)	Occupied spaces (IFC Section 903.3.1.3)
Design Intent	Life safety and property protection	Life safety	Life safety
Applicability	All IBC and NFPA occupancies	Group R occupancies to 4 stories	One- and two- family Dwellings and townhomes
Design Methods	Pipe schedule; control mode— discharge density/ design area; control mode— specific application; suppression mode	4-sprinklers/ compartments	2-sprinklers/ compartment (Designs using IRC P2904 are prescriptive)
Sprinklers	All listed and approved types	Listed residential	Listed residential
Minimum H_2O Supply Duration	30 to 120 minutes, depending on the design	30 minutes	10 minutes

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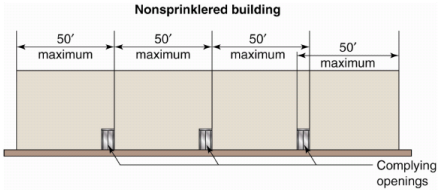
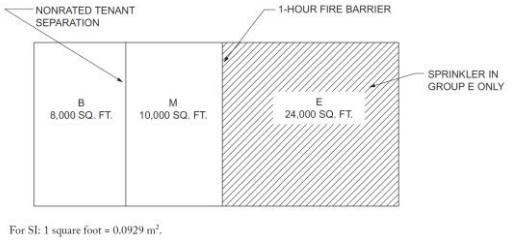
Section 903.2.11.1 – Automatic Sprinkler Systems



177

ACTIVITY

1. Fire Area Activity

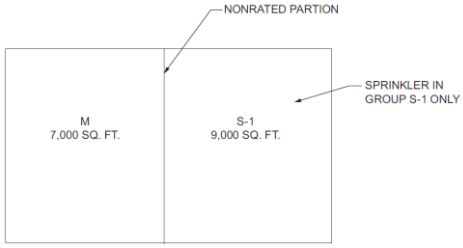


For SI: 1 square foot = 0.0929 m^2.

178

ACTIVITY

2. Fire Area Activity

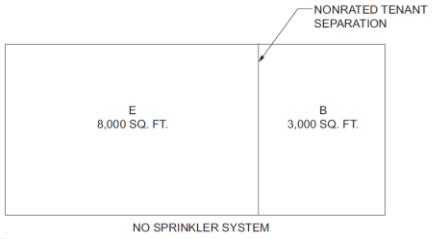


For SI: 1 square foot = 0.0929 m^2.

179

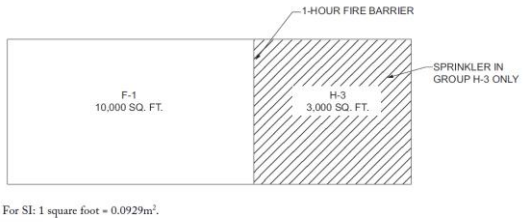
ACTIVITY

3. Fire Area Activity



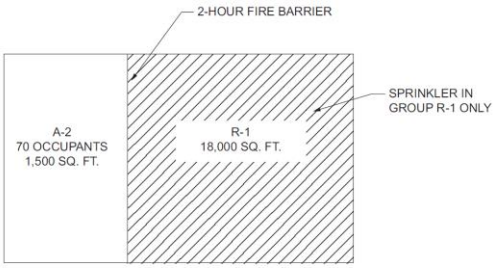
180

4. Fire Area Activity



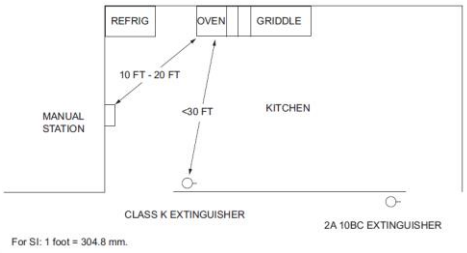
181

5. Fire Area Activity



182

Section 904 – Alternative Automatic Fire-extinguishing Systems



183

Section 905 – Standpipe Systems

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

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REQUIRED STANDPIPE INSTALLATIONS		
LOCATION OR USE	**NONSPRINKLERED BUILDING**	**SPRINKLERED BUILDING**
Building of 4 or more stories or where highest story located more than 30 feet above LLFDVA	Class III [1,2,3,6]	Class I
Building of 4 or more stories or where lowest story located more than 30 feet above HLFDVA	Class III [1,2,3,6]	Class I
Group A occupancies with occupant load exceeding 1,000.	Class I[4]	No requirement
Covered mall buildings.		Class I
Stages more than 1,000 square feet (93 m²).	Class III	Class III[5]
Underground buildings.		Class I

1. Class I standpipes permitted in basements equipped with automatic sprinkler system.
2. Class I manual dry standpipes permitted in open parking garages subject to freezing temperatures, provided hose connections located as for Class II systems.
3. Class I manual standpipes permitted in open parking garages where highest floor is less than 150 feet (45 720 mm) above the lowest level of fire department vehicle access.
4. Not required in open-air seating spaces without enclosed spaces.
5. Hose connections permitted to be supplied by sprinkler system.
6. Class I standpipes permitted in Group B and E occupancies, and where occupant-use hose lines will not be utilized by trained personnel or the fire department.

185

Section 906 – Fire Extinguishers

CLASSIFICATION	TYPE OF FIRE
Class A	Fires involving ordinary combustibles such as paper, cloth, etc.
Class B	Fires involving combustible or flammable liquids and gases.
Class C	Fires involving energized electrical equipment—the extinguishing agent must be nonconductive.
Class D	Fires involving combustible metals such as titanium, magnesium.
Class K	Fires involving deep fat fryers.

186

Section 907 – Fire Alarm and Detection Systems

OCCUPANCY	CONDITIONS	SYSTEM TYPE	EXCEPTIONS	SECTIONS
A	Occupant load ≥ 300, or > 100 above or below discharge level	Manual fire alarm system	1	907.2.1
	Occupant load ≥ 1,000	Emergency voice/alarm communications (EV/AC) system	2	907.2.1.1
B	Occupant load ≥ 500, or > 100 above or below discharge level	Manual fire alarm system	1	907.2.2
	Ambulatory care facilities	Electronically supervised automatic smoke detection system	15	907.2.2.1

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Section 907 – Fire Alarm and Detection Systems

OCCUPANCY	CONDITIONS	SYSTEM TYPE	EXCEPTIONS	SECTIONS
E	Occupant load > 50	Manual fire alarm system	1, 3	907.2.3
	Occupant load > 100	EV/AC system	None	
F	Two or more stories, and ≥ 500 above or below discharge level	Manual fire alarm system	1	907.2.4
H	H-5 and where organic coatings are manufactured	Manual fire alarm system	None	907.2.5
	Highly toxic gases, organic peroxides and oxidizers	Automatic smoke detection system		

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Section 907 – Fire Alarm and Detection Systems

OCCUPANCY	CONDITIONS	SYSTEM TYPE	EXCEPTIONS	SECTIONS
I	All Group I occupancies	Manual fire alarm system Automatic smoke detection system	4, 5	907.2.6
	Corridors in Group I-2 Condition 1 facilities and spaces open to corridors	Automatic smoke detection system	6	907.2.6.2
	Group I-3 occupancies	Manual fire alarm system	7	907.2.6.3
		Automatic smoke detection systems	8	907.2.6.3.3

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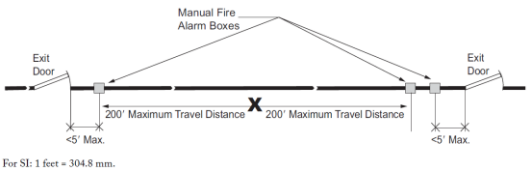
Section 907 – Fire Alarm and Detection Systems

M	Occupant load ≥ 500, or 100 above or below discharge level	Manual fire alarm system	1, 9	907.2.7
R	Group R-1	Manual fire alarm system	10, 11	907.2.8.1
		Automatic detection system	12	907.2.8.2
	Group R-2 with: 1. Any unit ≥ three stories above lowest discharge level, or 2. Any unit > one story below highest discharge level, or 3. > 16 dwelling units	Manual fire alarm system	1, 10, 12	907.2.9
	Group R-2 college and university buildings	Automatic smoke detection system	12	907.2.9.3

190

Section 907 – Fire Alarm and Detection Systems



For SI: 1 feet = 304.8 mm.

191

Section 910 – Smoke and Heat Removal

- Approved smoke and heat vents or mechanical smoke removal system must be installed in roofs of one-story buildings, or portions thereof, occupied for the following uses:
  - Group F-1 or S-1 having more than 50,000 square feet (4645 m^2) in undivided area (exceptions for aircraft repair hangars, sprinklered frozen-food warehouses and areas of buildings equipped with early suppression, fast response (ESFR) sprinklers).
  - Any occupancy containing high-piled combustible stock or rack storage in accordance with Section 413 and the IFC.

192

Section 911 – Fire Command Center

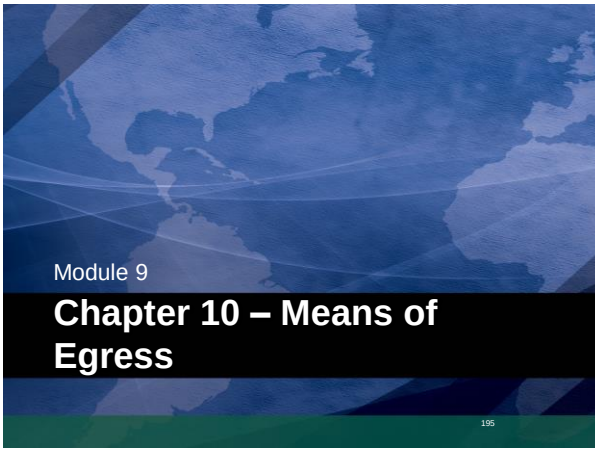
- Fire department communications unit.
- Fire detection and alarm system annunciator unit.
- Status indicators and controls for air-handling systems.
- Controls for unlocking stairway doors simultaneously.
- Emergency and standby power status indicators.

193

Section 911 – Fire Command Center

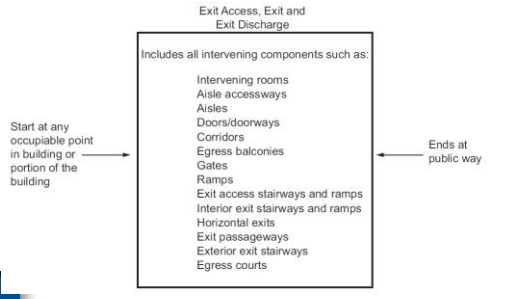
- Fire pump status indicators.
- Schematic building plans.
- Manual start and transfer features.
- Elevator fire recall switch.
- Approved “Building Card Information”

194



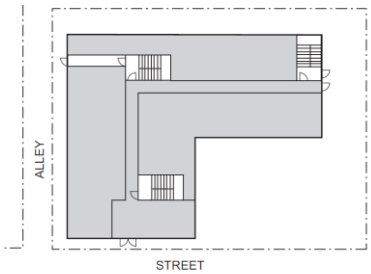
195

Chapter 10 – Means of Egress



196

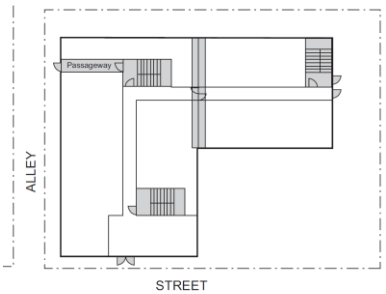
Exit Access



Shaded Area = Exit Access

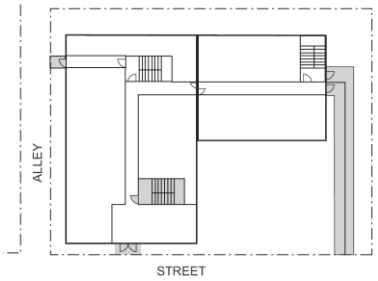
197

Exit



198

Exit Discharge



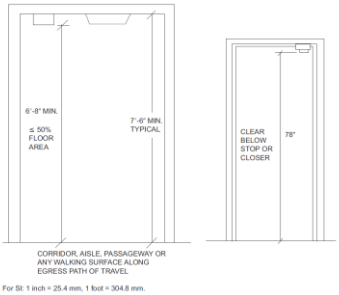
199

Three-part means of egress systems

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

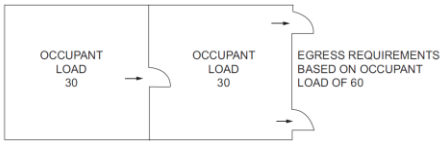
200

Section 1003 - General Means of Egress



201

Section 1004.2 - Cumulative Occupant Loads



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

202

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

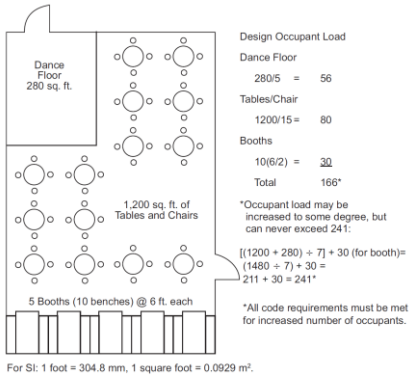
TABLE 1004.5
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR[a]
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal Baggage claim Baggage handling Concourse Waiting areas	 20 gross 300 gross 100 gross 15 gross
Assembly Gaming floors (keno, slots, etc.) Exhibit gallery and museum	 11 gross 30 net
Assembly with fixed seats	See Section 1004.6
Assembly without fixed seats Concentrated (chairs only—not fixed) Standing space Unconcentrated (tables and chairs)	 7 net 5 net 15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas Concentrated business use areas	150 gross See Section 1004.8
Courtrooms—other than fixed seating areas	40 net
Day care	35 net
Dormitories	50 gross
Educational Classroom area Shops and other vocational room areas	 20 net 50 net
Exercise rooms	50 gross
Group H-5 fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas Inpatient treatment areas Outpatient areas Sleeping areas	 240 gross 100 gross 120 gross
Kitchens, commercial	200 gross
Library Reading rooms Stack area	 50 net 100 gross
Locker rooms	50 gross
Mall buildings—covered and open	See Section 402.8.2
Mercantile Storage, stock, shipping areas	60 gross 300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools Rink and pool Decks	 50 gross 15 gross
Stages and platforms	15 net
Warehouses	500 gross

203

FOR EXAMPLE

1004.5.1 – Increased Occupant Load



Design Occupant Load

Dance Floor
280/5 = 56

Tables/Chair
1200/15 = 80

Booths
10(6/2) = 30

Total 166*

*Occupant load may be increased to some degree, but can never exceed 241:

[(1200 + 280) ÷ 7] + 30 (for booth)=
(1480 ÷ 7) + 30 =
211 + 30 = 241*

*All code requirements must be met for increased number of occupants.

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

204

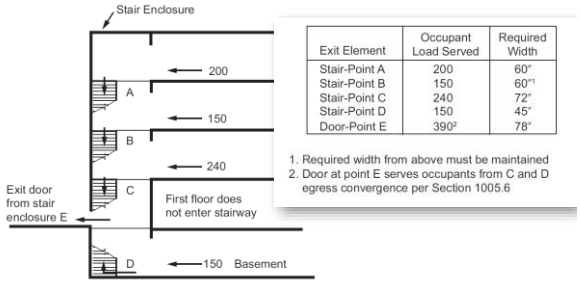
Section 1005.3 – Means of Egress Required Capacity

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

Occupant Load Served	x	Factor from Section 1005.3	=	Minimum Available Width

205

Exiting from Multiple Stories



Exit Element	Occupant Load Served	Required Width
Stair-Point A	200	60"
Stair-Point B	150	60"[1]
Stair-Point C	240	72"
Stair-Point D	150	45"
Door-Point E	390[2]	78"

1. Required width from above must be maintained
2. Door at point E serves occupants from C and D egress convergence per Section 1005.6

206

ACTIVITY

Occupant Load

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

18'/1.5' = 12 x 24 = 288 occupants
(Section 1004.6)

207

Occupant Load

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

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

208

Occupant Load

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

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

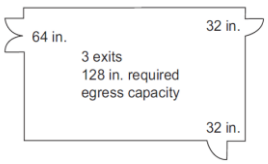
209

Occupant Load

4. Determine the design occupant load:
   a. 32,000-square-foot (2973 m^2) factory
   32,000/100 = 320 occupants
   b. 2,400-square-foot (112 m^2) sales room (grade floor)
   2,400/30 = 40 occupants
   c. 1,200-square-foot (112 m^2) apartment unit
   1,200/200 = 6 occupants

210

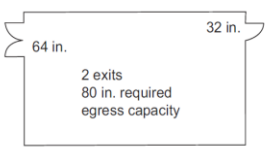
Section 1005.5 - Distribution of Egress Capacity



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

211

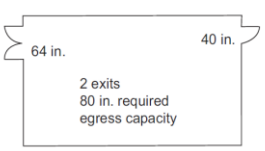
Section 1005.5 - Distribution of Egress Capacity



Not Permitted
Loss of single exit could result in less than ½ of the required capacity or width remaining

212

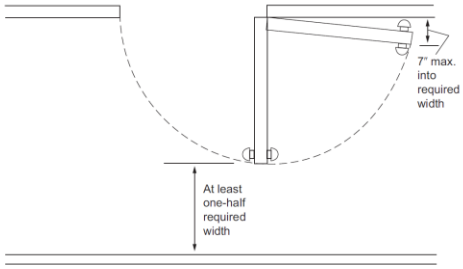
Section 1005.5 - Distribution of Egress Capacity



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

213

Section 1005.7.1 – Door Encroachment



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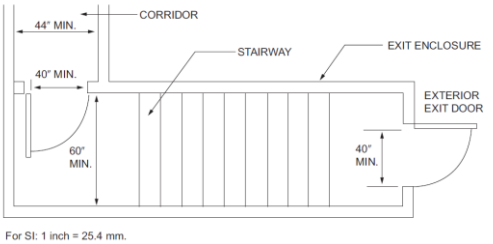
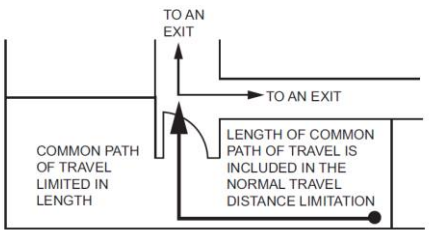
Application Example



215

Section 202 – Common Path of Egress Travel



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1006.2.1 – Spaces with One Exit or Exit Access Doorway

2018 IBC Table 1006.2.1 Page 262

TABLE 1006.2.1
SPACES WITH ONE EXIT OR EXIT ACCESS DOORWAY

OCCUPANCY	MAXIMUM OCCUPANT LOAD OF SPACE	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE (feet)		
		Without Sprinkler System (feet)		With Sprinkler System (feet)
		Occupant Load		
		OL ≤ 10	OL > 10	
A[e], E, M	49	75	75	75[e]
B	49	100	75	100[e]
F	49	75	75	100[e]
H-1, H-2, H-3	3	NP	NP	25[e]
H-4, H-5	10	NP	NP	75[e]
I-1, I-2[d], I-4	10	NP	NP	75[e]
I-3	10	NP	NP	100[e]
R-1	10	NP	NP	75[e]
R-2	20	NP	NP	125[e]
R-3[e]	20	NP	NP	125[e,f]
R-4[e]	20	NP	NP	125[e,f]
S[e]	29	100	75	100[e]
U	49	100	75	75[e]

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
a. Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where *automatic sprinkler systems* are permitted in accordance with Section 903.3.1.2.
b. Group H occupancies equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.5.
c. For a room or space used for assembly purposes having *fixed seating*, see Section 1029.8.
d. For the travel distance limitations in Group I-2, see Section 407.4.
e. The *common path of egress travel* distance shall only apply in a Group R-3 occupancy located in a mixed occupancy building.
f. The length of *common path of egress travel* distance in a Group S-2 *open parking garage* shall be not more than 100 feet.
g. For the travel distance limitations in Groups R-3 and R-4 equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.3, see Section 1006.2.2.6.

217

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

TABLE 1006.3.3(1)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE
Basement, first, second or third story above grade plane	R-2[a,b]	4 dwelling units	125 feet
Fourth story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 3048 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with *emergency escape and rescue openings* in accordance with Section 1030.
b. This table is used for R-2 occupancies consisting of *dwelling units*. For R-2 occupancies consisting of *sleeping units*, use Table 1006.3.3(2).

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

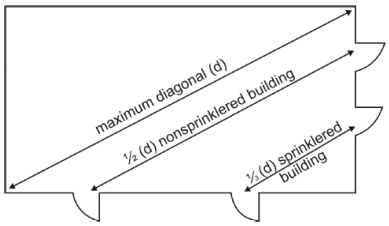
TABLE 1006.3.3(2)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM OCCUPANT LOAD PER STORY	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE (feet)
First story above or below grade plane	A, B[a], E P[a], M, U	49	75
	H-2, H-3	3	25
	H-4, H-5, I, R-1, R-2[c,e]	10	75
	S[b,d]	29	75
Second story above grade plane	B, F, M, S[d]	29	75
Third story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with *emergency escape and rescue openings* in accordance with Section 1030.
b. Group B, F and S occupancies in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 shall have a maximum *exit access* travel distance of 100 feet.
c. This table is used for R-2 occupancies consisting of *sleeping units*. For R-2 occupancies consisting of *dwelling units*, use Table 1006.3.3(1).
d. The length of *exit access* travel distance in a Group S-2 *open parking garage* shall be not more than 100 feet.

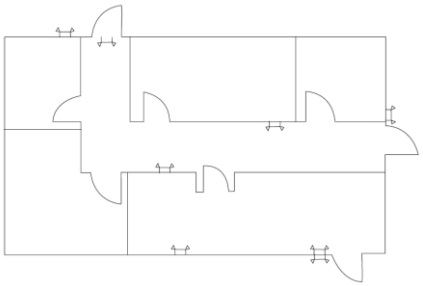
219

Section 1007 – Exit and Exit Access Configuration



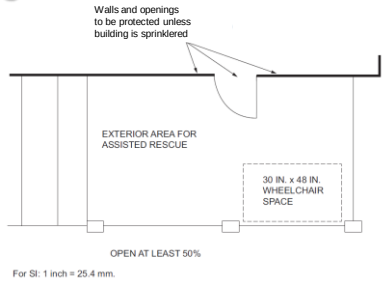
220

Section 1008 – Means of Egress Illumination



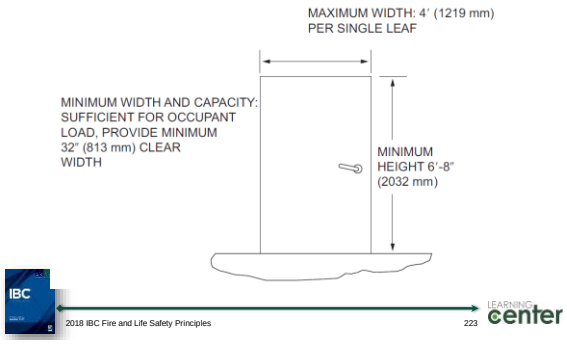
221

Section 1009 – Accessible Means of Egress



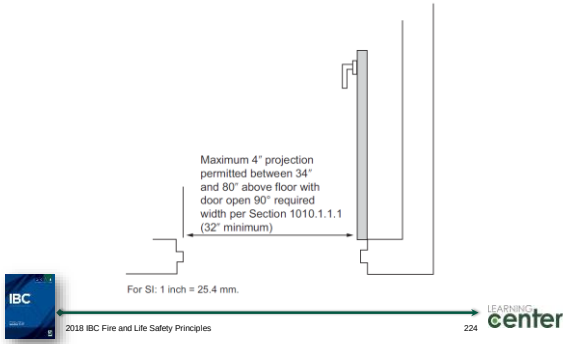
222

Section 1010.1.1 – Size of Doors



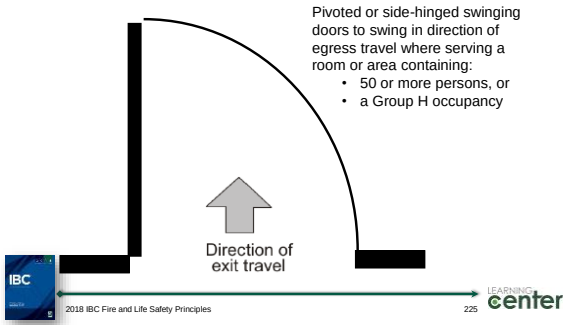
223

Section 1010.1.1 – Size of Doors



224

Section 1010.1.2 – Door Swing



225

Section 1010.1.4 – Special Doors

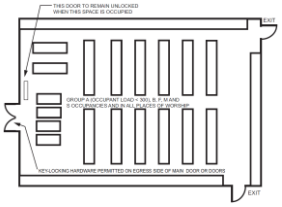
- Revolving doors
- Power-operated doors
- Horizontal sliding doors
- Locking arrangements in education occupancies
- Security grilles

226

Section 1010.1.9 – Door Operations

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

Exception 2

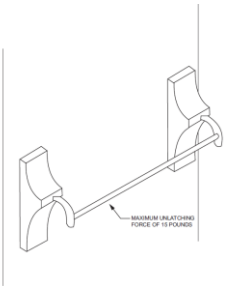


227

Section 1010.1.10 – Panic and Fire Exit Hardware

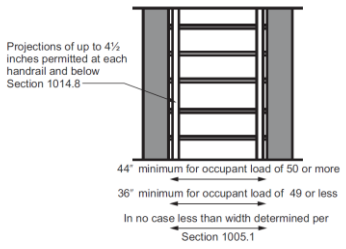
Swinging doors provided with a latch or lock shall be provided with panic hardware where serving:

- 50 or more persons in a Group A or E occupancy, or
- a Group H occupancy



228

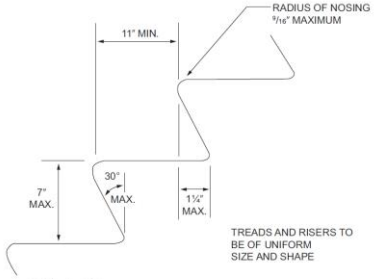
Section 1011.2– Stairway Width and Capacity



For SI: 1 inch = 25.4 mm.

229

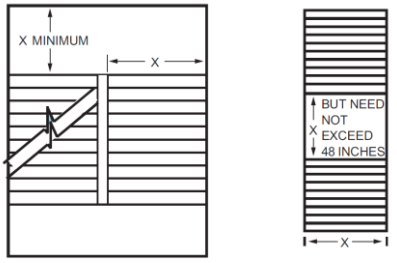
Section 1011.5 – Stair Treads and Risers



For SI: 1 inch = 25.4 mm.

230

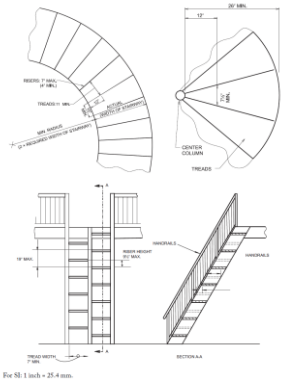
Section 1011.6 – Stairway Landings



For SI: 1 inch = 25.4 mm.

231

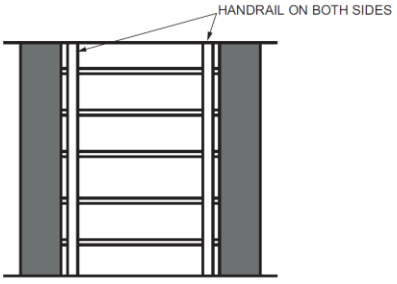
Sections 1011.9 through 1011.15– Alternate Stairways



For SI: 1 inch = 25.4 mm.

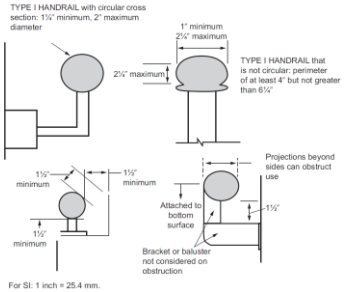
232

Section 1011.11 – Handrails



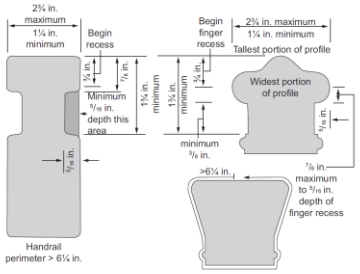
233

Section 1014.3 – Handrail Graspability



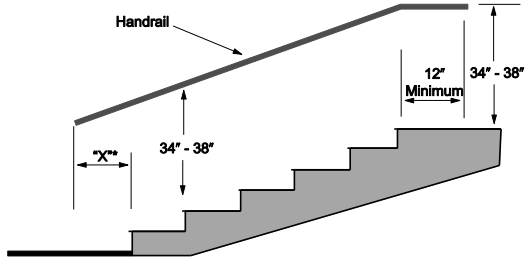
234

Section 1014.3 – Handrail Graspability



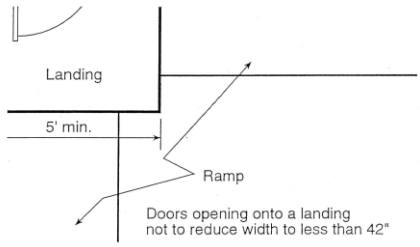
235

Section 1014.6 – Handrail Extensions



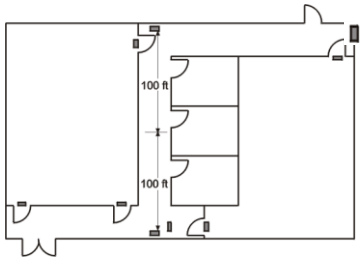
236

Section 1012 – Ramps



237

Section 1013 – Exit Signs

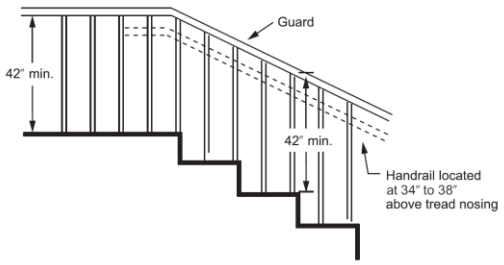


238

Section 1013.6.3 – Power Source

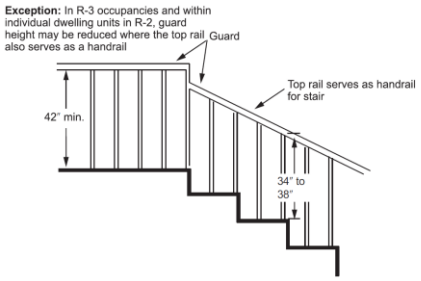
239

Section 1015 – Required Guards



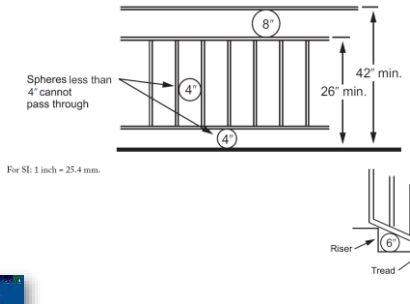
240

Section 1015.3 – Guard Height



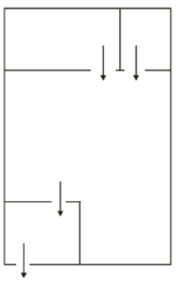
241

Section 1015.4 – Guard Opening Limitations



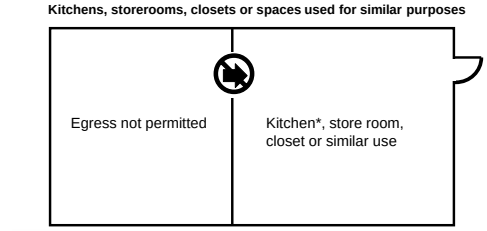
242

Section 1016.2 – Egress Through Intervening Spaces



243

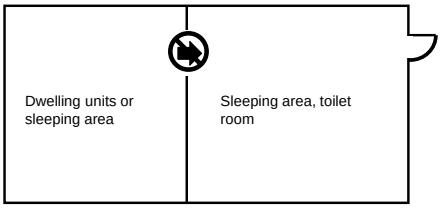
Section 1016.2 – Exit Through Intervening Spaces



***Exception:**
Kitchen within same dwelling unit or guestroom.

244

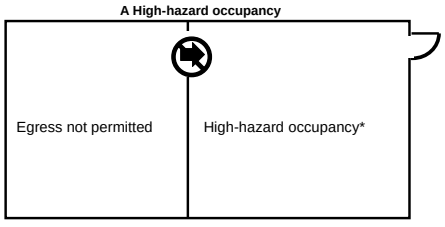
Section 1016.2 – Exit Through Intervening Spaces



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

245

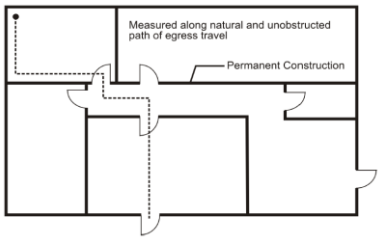
Section 1016.2 – Exit Through Intervening Spaces



***Exception**
When space to be entered is the same occupancy group.

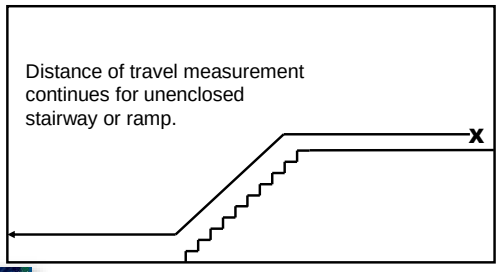
246

Section 1017 – Exit Access Travel Distance



247

Section 1017 – Exit Access Travel Distance



248

Table 1017.2 – Exit Access Travel Distance

REFER TO CODE BOOK

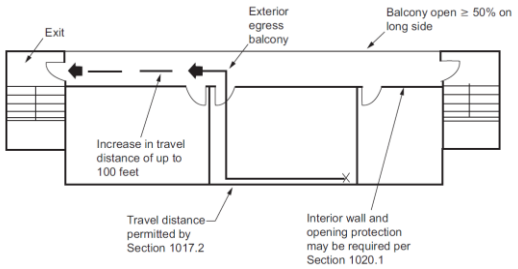
2018 IBC Table 1017.2 Page 285

TABLE 1017.2
EXIT ACCESS TRAVEL DISTANCE[a]

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, M, R, S-1	200[e]	250[b]
I-1	Not Permitted	250[b]
B	200	300[c]
F-2, S-2, U	300	400[c]
H-1	Not Permitted	75[d]
H-2	Not Permitted	100[d]
H-3	Not Permitted	150[d]
H-4	Not Permitted	175[d]
H-5	Not Permitted	200[c]
I-2, I-3	Not Permitted	200[c]
I-4	150	200[c]

249

Section 1017.2.1 – Exterior Egress Balcony Increase



250

REFER TO CODE BOOK

2018 IBC Table 1020.1 Page 287

Table 1020.1 – Corridor Fire-Resistance Rating

TABLE 1020.1
CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system[d]
H-1, H-2, H-3	All	Not Permitted	1
H-4, H-5	Greater than 30	Not Permitted	1
A, B, E, F, M, S, U	Greater than 30	1	0
R	Greater than 10	Not Permitted	0.5[c]/1[d]
I-2[a]	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1[b]
I-4	All	1	0

a. For requirements for occupancies in Group I-2, see Sections 407.2 and 407.3.

b. For a reduction in the *fire-resistance rating* for occupancies in Group I-3, see Section 408.8.

c. Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.

d. Group R-3 and R-4 buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where *automatic sprinkler systems* are permitted in accordance with Section 903.3.1.3.

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REFER TO CODE BOOK

2018 IBC Table 1020.2 Page 287

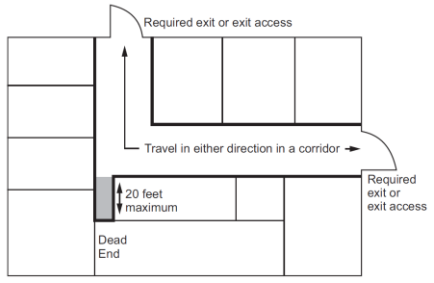
Table 1020.2 – Minimum Corridor Width

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facility not listed in this table	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in *ambulatory care facilities*	72
Group I-2 in areas where required for bed movement	96

252

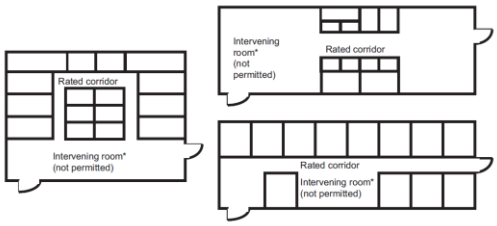
Section 1020.4 – Dead Ends



For SI: 1 foot = 304.8 mm.

253

Section 1020.6 – Corridor Continuity



* Foyers, lobbies or reception rooms constructed as required for corridors not to be considered as intervening rooms.

254

Section 1021 – Egress Balconies

Balconies considered as a portion of the means of egress must comply with the same requirements as corridors for:

- Width.
- Headroom.
- Dead ends.
- Projections.

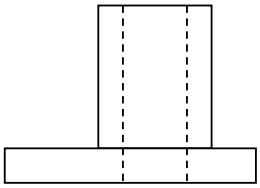
255

Section 1023 – Interior Exit Stairways and Ramps

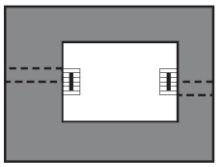
- Interior exit stairways and ramps must be enclosed as specified in Section 1023.2.
- They shall lead directly to the exterior of the building or be extended to the building's exterior with an exit passageway.
- An interior exit stairway or ramp shall not be used for any purpose that interferes with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

256

Section 1023.2 – Stairway Construction



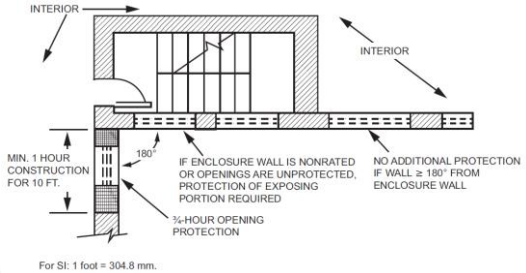
Elevation



Plan

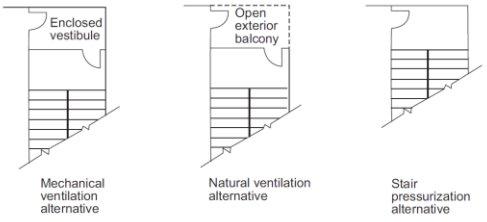
257

Section 1023.7– Interior Exit Stairway and Ramp Exterior Walls



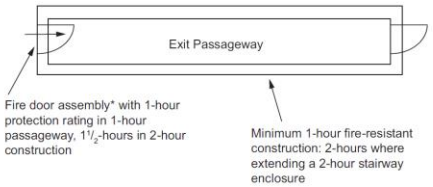
258

Section 1023.11 – Smokeproof Enclosures and Pressurized Stairways



259

Section 1024 – Exit Passageways

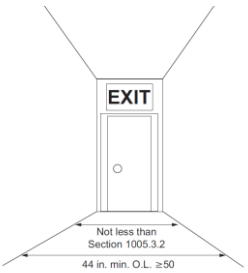


*Maximum transmitted temperature < 450° above ambient at end of 30 minutes of fire test. (Temperature rise not regulated in sprinklered building.)

For SI: °C = [°F-32]/1.8.

260

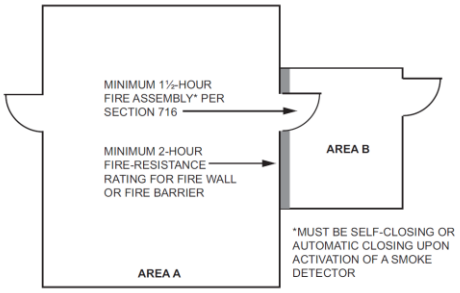
Section 1024 – Exit Passageways



For SI: 1 inch = 25.4 mm.

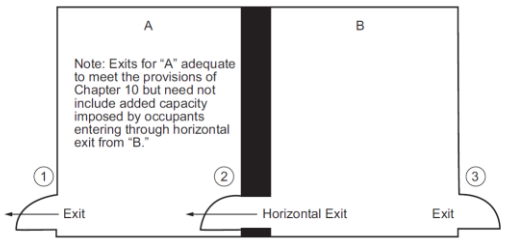
261

Section 1026 – Horizontal Exits



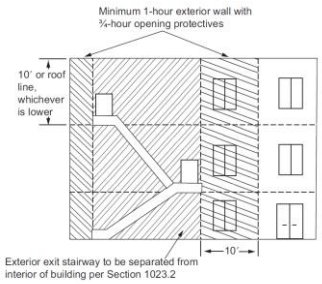
262

Section 1026.4 – Refuge Areas



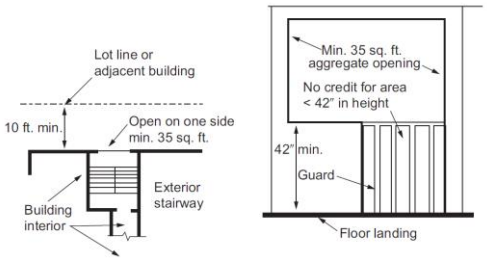
263

Section 1027 – Exterior Exit Ramps and Stairways



264

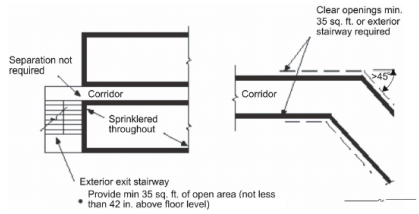
Section 1027 – Exterior Exit Ramps and Stairways



For SI: 1 inch - 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

265

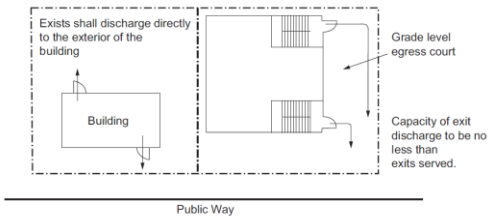
Section 1027.6 – Exterior Ramps and Stairway Protection



For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m².

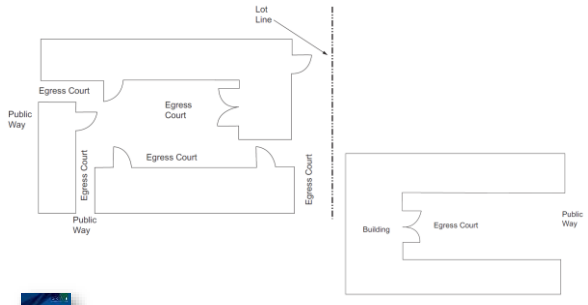
266

Section 1028 – Exit Discharge



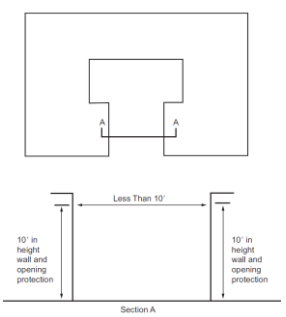
267

Section 1028.4 –Egress Courts



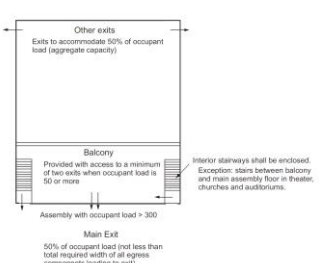
268

Section 1028.4.2 – Egress Court Construction



269

Section 1029 – Assembly Uses



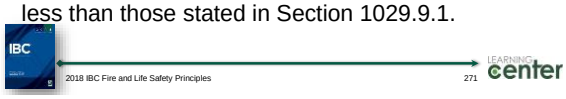
270

Section 1029.6 – Capacity of Aisles for Assembly Seating Areas

The minimum required capacity is determined from:

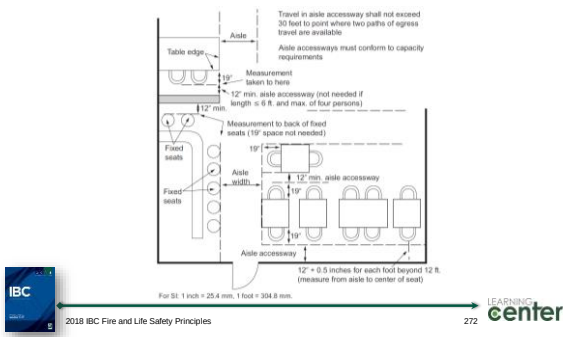
- Buildings without smoke-protected seating (Section 1029.6.1).
- Buildings with smoke-protected seating (Section 1029.6.2).
- Open-air assembly seating (Section 1029.6.3).

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



271

Section 1029.10.1 – Means of Egress for Seating at Tables



272

Section 1030 – Emergency Escape and Rescue Openings

Exterior emergency escape and rescue openings must be provided in:

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

Openings are to be provided in the following areas:

- Basements.
- Sleeping rooms below the fourth story.

273

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

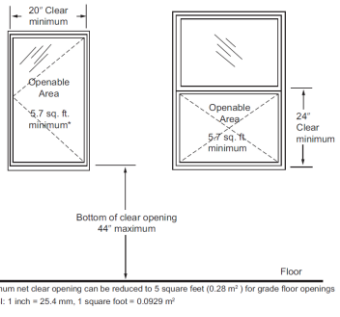
TABLE 1006.3.3(1)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE
Basement, first, second or third story above grade plane	R-2[a,b]	4 dwelling units	125 feet
Fourth story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 3048 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with *emergency escape and rescue openings* in accordance with Section 1030.
b. This table is used for R-2 occupancies consisting of *dwelling units*. For R-2 occupancies consisting of *sleeping units*, use Table 1006.3.3(2).

274

Table 1030.2 – Minimum Size



*Minimum net clear opening can be reduced to 5 square feet (0.28 m²) for grade floor openings
For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m²

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Means of Egress Activity

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

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Means of Egress Activity

2. What is the minimum required corridor width:

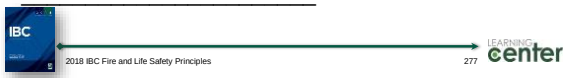
a. For access to mechanical equipment **24 inches**

b. Within a dwelling unit **36 inches**

c. Serving 100 or more occupants in a Group E occupancy **72 inches**

d. For Group I-2 bed movement areas **96 inches**

e. Serving an occupant load less than 50 **36 inches**



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Means of Egress Activity

3. What is the maximum permitted travel distance, including exterior egress balcony travel, for a sprinklered Group R-1 occupancy?

350 feet (106 680 mm), based on 250' + 100' (76 200 mm + 30 480 mm) maximum balcony travel (Table 1017.2 and Section 1017.2.1)

4. How many intermediate rails are required for a 30-foot (9144 mm) wide stair that has a required width of 18 feet 9 inches (5738 mm)?

18' 9" = 225"/60 — four paths - three intermediate rails (Section 1014.9)

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Means of Egress Activity

5. How many means of egress are required from the following spaces, assuming the common path of travel is within the allowable limits?

a. 4,000-square-foot office **4,000/150 = 26 = 1**

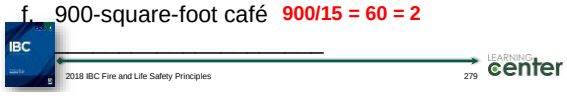
b. 450-square-foot conference room **450/15 = 30 = 1**

c. 6,000-square-foot warehouse **6,000/500 = 12 = 1**

d. 2,400-square-foot apartment **2,400/200 = 12 = 1**

e. 1,800-square-foot sales room **1,800/60 = 30 = 1**

f. 900-square-foot café **900/15 = 60 = 2**



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Means of Egress Activity

6. What is the minimum required width of an egress court serving a Group M occupancy?

44 inches (1118 mm) (Section 1028.4.1)

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Conclusion

- Review
- Surveys
- Questions

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Final Reflection

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

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

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