

# **BUILDING AND FIRE CODES AND HOW THEY RELATE TO THE U.S. ARMY CORPS OF ENGINEERS**

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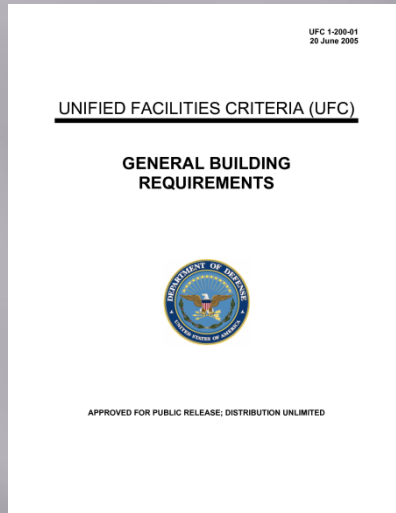


# Learning Objectives

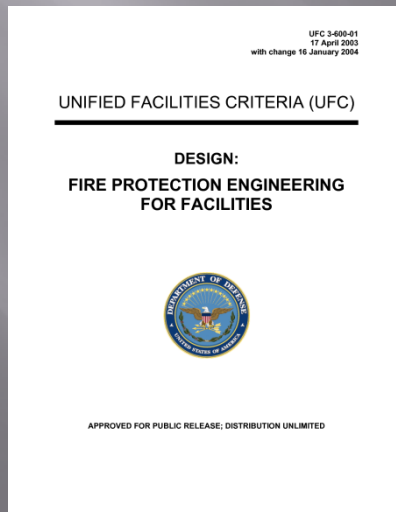
At the end of this program, participants will be able to:

1. Identify the governing documents for DOD fire protection design
2. Identify applicable IBC and NFPA 101 requirements for fire protection
3. Identify how “Absence of Criteria” requirements are implemented
4. Identify requirements for fire department access

# Governing Documents



- UFC 1-200-01, “General Building Requirements”



- UFC 3-600-01, “Fire Protection Engineering For Facilities”



# UFC 1-200-01

- Current Edition: Change 2, November 28, 2011
- Defines International Building Code 2009 Edition as the building code for DOD projects
- As modified in Chapters 2 and 3
- All references in IBC to IFC shall be considered as references to NFPA 1
- All references in IBC to IFGC shall be considered as references to NFPA 58





# UFC 1-200-01

- Use IBC Chapter Exclusively
- 1, 2, 5, 12\*, 14, 17\* 20, 23, 24, 25, 26, 28, 31, 32, 34\*, 35\*
- Use IBC and UFC 3-600-01
- 3, 6, 7, 33
- Use UFC 3-600-01 in Lieu of IBC
- 4, 8, 9, 10, 13



# UFC 1-200-01

- Use of Other Uniform Facilities Criteria
- Chapters 16, 18, 19, 21, 22 Use Chapter and UFC 3-301-01
- Chapter 27, Use Chapter and lots of other UFCs
- Chapter 28, Use UFC 3-410-01FA
- Chapter 29, Use Chapter and UFC 3-420-01
- Chapter 30, Use Chapter, UFC 3-600-01 and ITG 01-01



# How Does This Apply To Me

But What Does This All Mean To Me For The  
Design And Review Of Projects?

Let's Look At Some Specific Elements of Building  
Design

# General Building Design

- Building “Occupancy”
- IBC Chapter 3
- So

## SECTION 302 CLASSIFICATION

**302.1 General.** Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed below. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508. Where a structure is proposed for a purpose that is not specifically provided for in this code, such structure shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5
2. Business (see Section 304): Group B
3. Educational (see Section 305): Group E
4. Factory and Industrial (see Section 306): Groups F-1 and F-2
5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5
6. Institutional (see Section 308): Groups I-1, I-2, I-3 and I-4
7. Mercantile (see Section 309): Group M
8. Residential (see Section 310): Groups R-1, R-2, R-3 and R-4
9. Storage (see Section 311): Groups S-1 and S-2
10. Utility and Miscellaneous (see Section 312): Group U

- Follow IBC Criteria From Chapter 3

# General Building Design

- Building Occupant Load
- IBC Chapter 10
- So
- Follow NFPA 101 Table 7.3.1.2

have a program of scheduled maintenance during times of building shutdown or low building activity. Repairs shall be performed within 24 hours of breakdown.

**7.2.13.11 Earthquake Protection.** Elevators shall have the capability of orderly shutdowns during earthquakes at locations where such shutdowns are an option of ASME A17.1/CSA B44, *Safety Code for Elevators and Escalators*.

**7.2.13.12 Signage.** Signage shall comply with 7.10.8.4.

**7.3 Capacity of Means of Egress.**

**7.3.1 Occupant Load.**

**7.3.1.1 Sufficient Capacity.**

**7.3.1.1.1** The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof.

**7.3.1.1.2** For other than existing means of egress, where more than one means of egress is required, the means of egress shall be of such width and capacity that the loss of any one means of egress leaves available not less than 50 percent of the required capacity.

**7.3.1.2\* Occupant Load Factor.** The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use as specified in Table 7.3.1.2, Figure 7.3.1.2(a), and Figure 7.3.1.2(b). Where both gross and net area figures are given for the same occupancy, calculations shall be made by applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified and by applying the net area figure to the net area of the portion of the building devoted to the use for which the net area figure is specified.

**Table 7.3.1.2 Occupant Load Factor**

Use	(ft <sup>2</sup> per person)*	(m <sup>2</sup> per person)*
<b>Assembly Use</b>		
Concentrated use, without fixed seating	7 net	0.65 net
Less concentrated use, without fixed seating	15 net	1.4 net
Bench-type seating	1 person/18 linear in.	1 person/455 linear mm
Fixed seating	Number of fixed seats	Number of fixed seats
Waiting spaces	See 12.1.7.2 and 13.1.7.2.	See 12.1.7.2 and 13.1.7.2.
Kitchens	100	9.3
Library stack areas	100	9.3
Library reading rooms	50 net	4.6 net
Swimming pools	50 (water surface)	4.6 (water surface)
Swimming pool decks	30	2.8
Exercise rooms with equipment	50	4.6

**Table 7.3.1.2 Continued**

Use	(ft <sup>2</sup> per person)*	(m <sup>2</sup> per person)*
Exercise rooms without equipment	15	1.4
Stages	15 net	1.4 net
Lighting and access catwalks, galleries, gridirons	100 net	9.3 net
Casinos and similar gaming areas	11	1
Skating rinks	50	4.6
<b>Educational Use</b>		
Classrooms	20 net	1.9 net
Shops, laboratories, vocational rooms	50 net	4.6 net
<b>Day-Care Use</b>	35 net	3.3 net
<b>Health Care Use</b>		
Inpatient treatment departments	240	22.3
Sleeping departments	120	11.1
Ambulatory health care	100	9.3
<b>Detention and Correctional Use</b>	120	11.1
<b>Residential Use</b>		
Hotels and dormitories	200	18.6
Apartment buildings	200	18.6
Board and care, large	200	18.6
<b>Industrial Use</b>		
General and high hazard industrial	100	9.3
Special-purpose industrial	NA	NA
<b>Business Use (other than below)</b>	100	9.3
Air traffic control tower observation levels	40	3.7
<b>Storage Use</b>		
In storage occupancies	NA	NA
In mercantile occupancies	300	27.9
In other than storage and mercantile occupancies	500	46.5
<b>Mercantile Use</b>		
Sales area on street floor <sup>a</sup>	30	2.8
Sales area on two or more street floors <sup>a</sup>	40	3.7
Sales area on floor below street floor <sup>a</sup>	30	2.8
Sales area on floors above street floor <sup>a</sup>	60	5.6
Floors or portions of floors used only for offices	See business use.	See business use.

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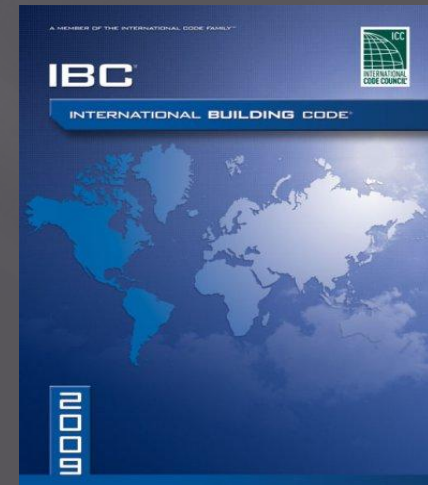
**2009**

# General Building Design

- Occupancy Separation
- IBC Chapter 5
- So
- Follow IBC Criteria from Table 508.4

**TABLE 508.4  
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)**

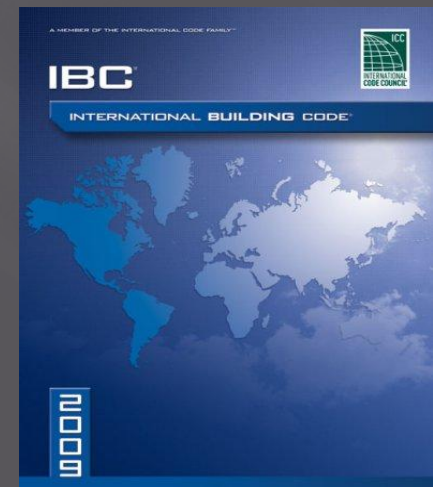
OCCUPANCY	A <sup>d</sup> , E		I-1, I-3, I-4		I-2		R		F-2, S-2 <sup>b</sup> , U		B, F-1, M, S-1		H-1		H-2		H-3, H-4, H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A <sup>d</sup> , E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3 <sup>a</sup>
I-1, I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP
R	—	—	—	—	—	—	N	N	1 <sup>c</sup>	2 <sup>c</sup>	1	2	NP	NP	3	NP	2	NP
F-2, S-2 <sup>b</sup> , U	—	—	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3 <sup>a</sup>
B, F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2 <sup>a</sup>
H-1	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP
H-3, H-4, H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 <sup>c, f</sup>	NP





# General Building Design

- Allowable Building Heights and Area
- IBC Chapter 5
- So
- Use IBC Criteria from Table 503



# General Building Design

- Building Element Fire Resistance Requirements
- IBC Chapter 6
- So
- Use IBC and UFC





# General Building Design

## Building Element Fire Resistance Requirements

**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 <sup>d</sup>	B	A <sup>d</sup>	B	HT	A <sup>d</sup>	B
Primary structural frames <sup>a</sup> (see Section 202)	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	HT	1	0
Bearing walls									
Exterior <sup>f, s</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions	0	0	0	0	0	0	See Section 602.4.6	0	0
Interior <sup>e</sup>									
Floor construction and secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and secondary members (see Section 202)	1 1/2 <sup>b</sup>	1 <sup>b, c</sup>	1 <sup>b, c</sup>	0 <sup>c</sup>	1 <sup>b, c</sup>	0	HT	1 <sup>b, c</sup>	0

# Specific Building Design

- Shaft Enclosures
- IBC Section 708
- So
- Use IBC and UFC



- Fire Resistance Rating IBC Section 708.4
- Rating Dependant on Connected Stories
- However

# Specific Building Design

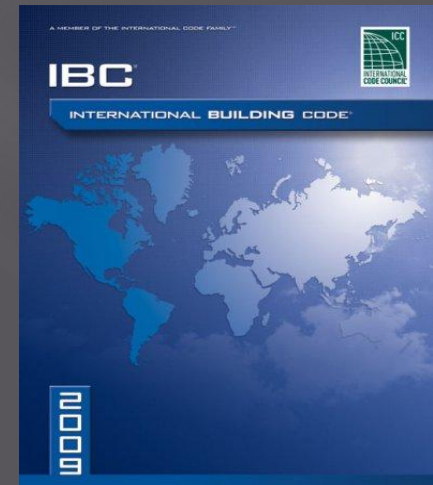
- UFC 3-600-01
- Section 6-30.1



- “For Navy and DLA projects, provide 2-hour fire resistant rated construction for all elevator hoistways.”

# Specific Building Design

- Mezzanines
- IBC Section 505
- So
- Follow IBC
- Area limitation (IBC 1/2 vs. LSC 1/3)
- Openness
- However







# Specific Building Design

- IBC Section 505.3 “Egress”
- Follow requirements of LSC
- Section 7.4.1.1 required number of exits
- Section 7.3.1.6 egress capacity (add to floor below)

# Fire Protection Systems

- IBC Chapter 9
- So
- Follow UFC 3-600-01 for required installation
- Follow NFPA standards and UFC for design





# Fire Protection Systems

- UFC 3-600-01 Section 4-2.2
- “Complete sprinkler protection must be provided for all new or renovated DOD facilities”.



# Fire Protection Systems

- Automatic Sprinkler Exceptions
  - Non-mission critical
  - Type I or II construction
  - Less than 15,000 ft<sup>2</sup>
- Type III, IV, or V
  - Less than 5,000 ft<sup>2</sup>



# Fire Protection Systems

- UFC 3-600-01 Section 5-3
- “Fire alarm evacuation systems must be provided in the following locations.”
- Buildings required by NFPA 101
- Buildings requiring automatic detection or suppression systems





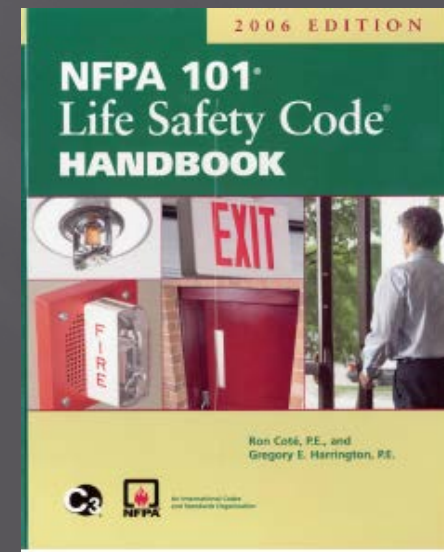
# Life Safety

- IBC Chapter 10
- So
- Comply with NFPA 101
- UFC 3-600-01 Section 2-1.1
- “Comply with NFPA 101 for building construction related to egress and safety to life”



# Life Safety

- All egress requirements based on “occupancy” from LSC Section 6.1
- This may not be the same as “building occupancy” used in building design



# Life Safety

- IBC
- A (1-5), B, E, F (1-2), H (1-5), I (1-4), M, R (1-4), S, and U
- LSC
- Assembly, Education, Day Care, Health Care, Ambulatory Health Care, Detention and Correctional, Residential, Residential Board and Care, Mercantile, Business, and Storage



# UFC 3-600-01

- “Absence of Criteria”
- Section 1-3.3
- “When a specific application is not covered by the criteria of this UFC, follow national building codes, recognized industry standards, and standard engineering practices. In absence of such technical information, contact the DOD component authority having jurisdiction”

# Absence of Criteria

- Vertical Openings
- What is Opening
- “Atrium”
- “Convenience Opening”
- “Communicating Space”

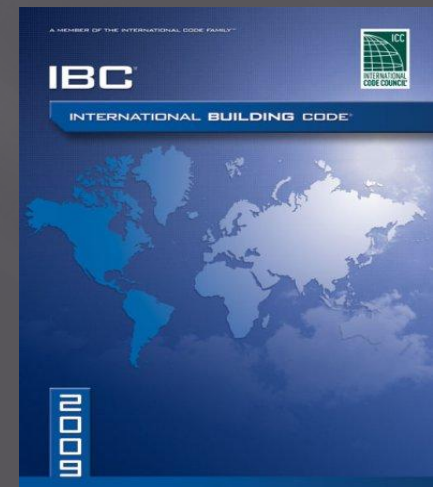
# Absence of Criteria

- Atrium
- Follow IBC or NFPA 101 Criteria
- IBC Section 404, “Atriums”
- NFPA 101 Section 8.6, “Vertical Openings”
- What are Advantages and Consequences of Each?



# Atrium IBC

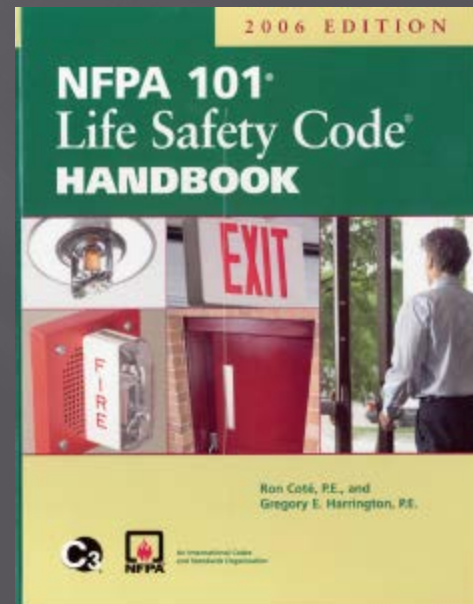
- Automatic Sprinkler and Fire Alarm Systems
- Smoke Control
- Enclosure
- Standby Power
- Low Fire Hazard
- Travel Permitted Within Atrium



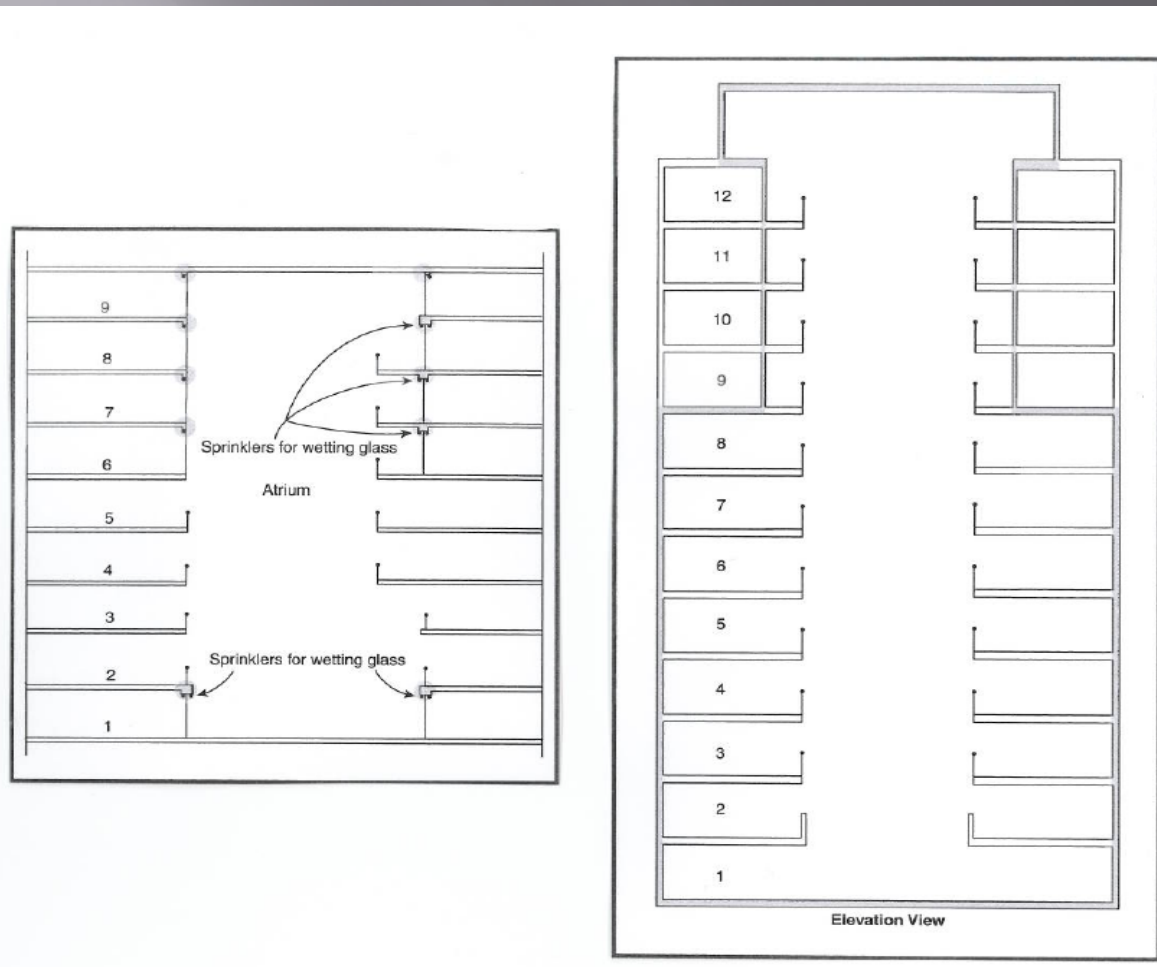


# Atrium NFPA 101

- Automatic Sprinkler Protection
- Engineering Analysis (smoke control)
- Enclosure
- Low or Ordinary Fire Hazards
- Travel Permitted Within Atrium



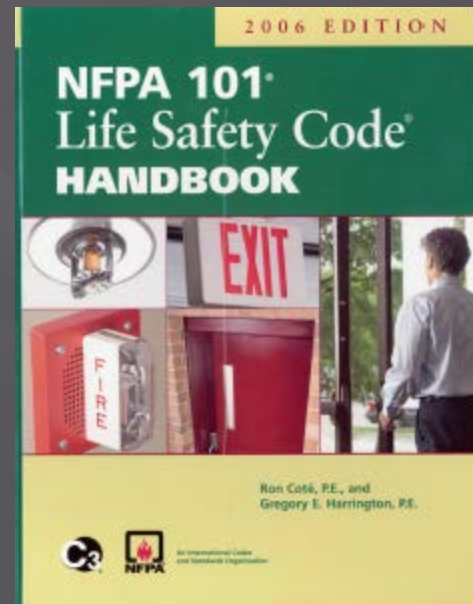
# Atrium





# Atrium NFPA 101

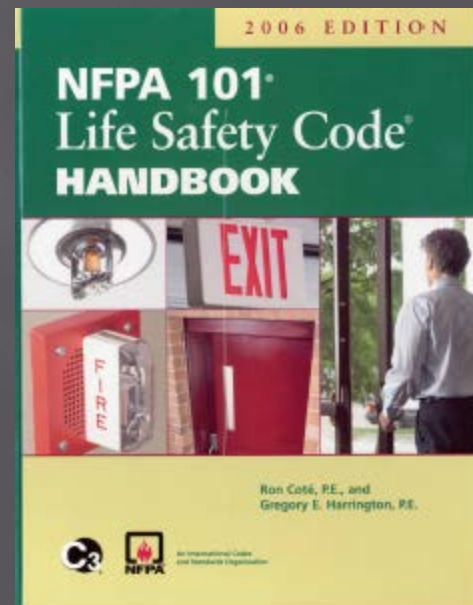
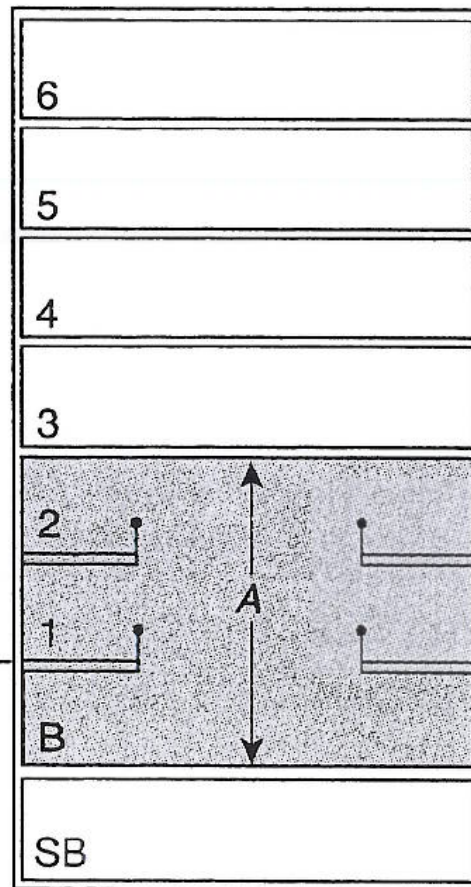
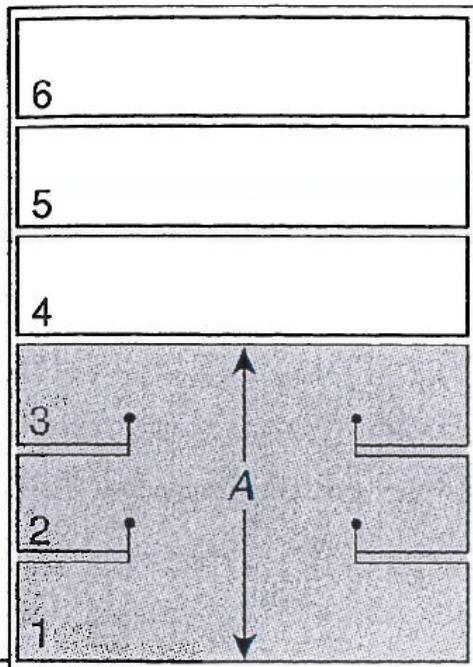
- Is Space Under Consideration an Atrium or is it a:
- Communicating Space?
- Convenience Opening?



# Communicating Space

- Connect not more than 3 stories
- Lowest or next to lowest story is street floor
- Open and unobstructed
- 1-hour separation (smoke barrier and AS)
- Ordinary hazard with sprinkler system (low)
- Considered as single floor area for egress capacity
- Occupant in, egress to not less than 1 exit on level
- Occupant out, 1 exit without having to enter

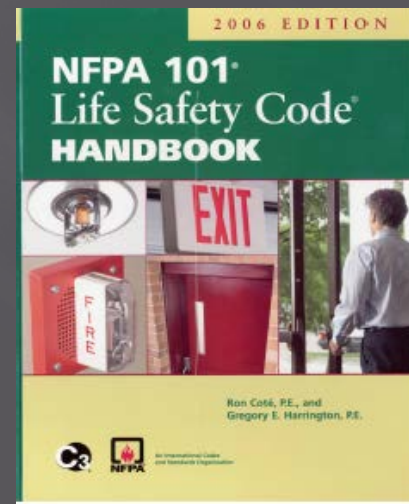
# Communicating Space





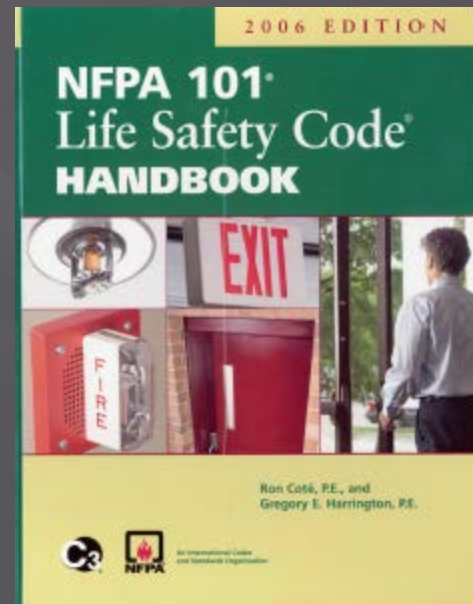
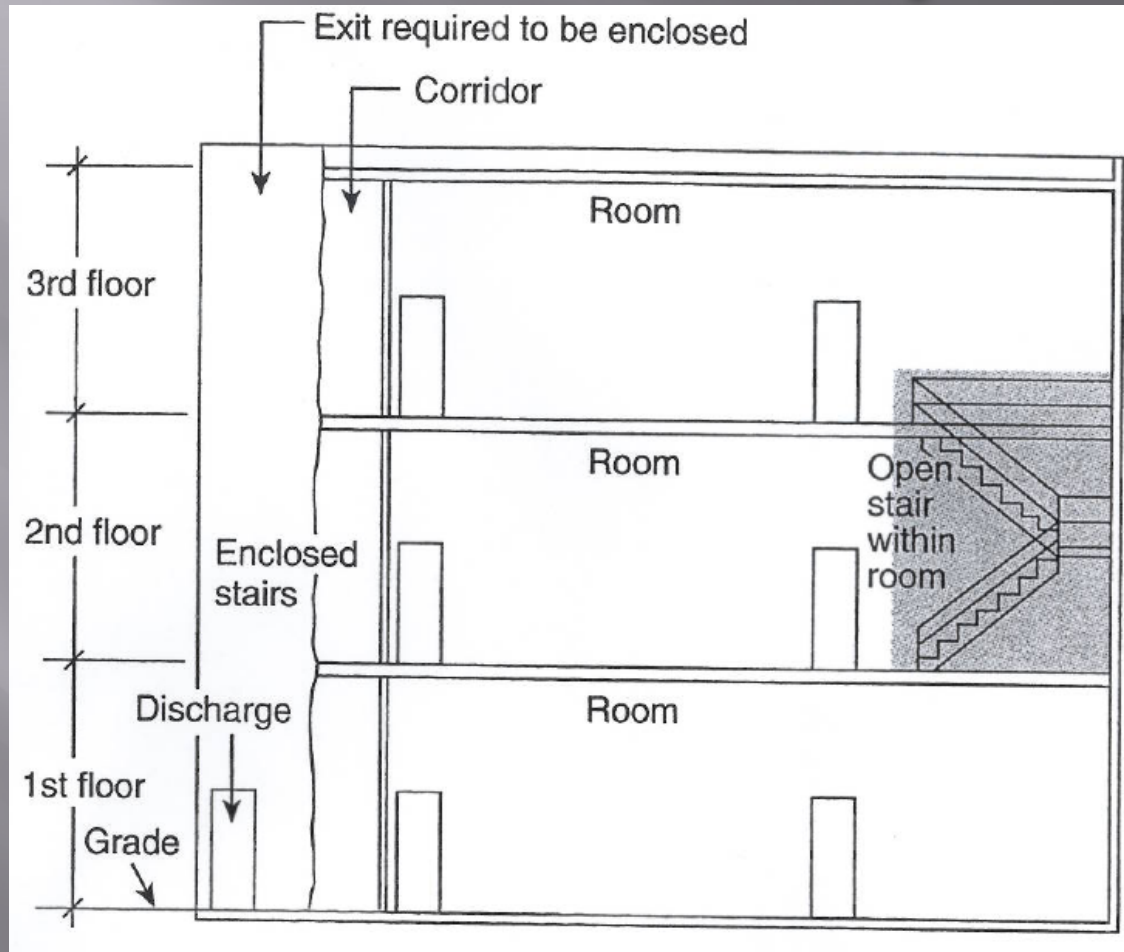
# Convenience Opening

- Connect not more than 2 adjacent stories
- Separated from other unprotected openings
- Separated from corridors
- Shall not serve as a means of egress





# Convenience Opening



# Fire Department Access

- Building Access
  - UFC 3-600-01, Section 2-10
  - Floor area greater than 5,000 ft<sup>2</sup>
  - More than two stories
  - Then
- 
- At least one all weather ground access
  - Paved
  - Start from road
  - Terminate maximum 33 feet from building



# Fire Department Access

- Building Access
- Residential Facilities
- Then



- All weather ground access to 3 sides
- Minimum 2 sides having access to sleeping rooms

# Fire Department Access

- Building Access
- Aerial Apparatus
- 4 stories or more
- New warehouses
- Then
- All weather ground access to 2 sides of **perimeter**





# Fire Department Access

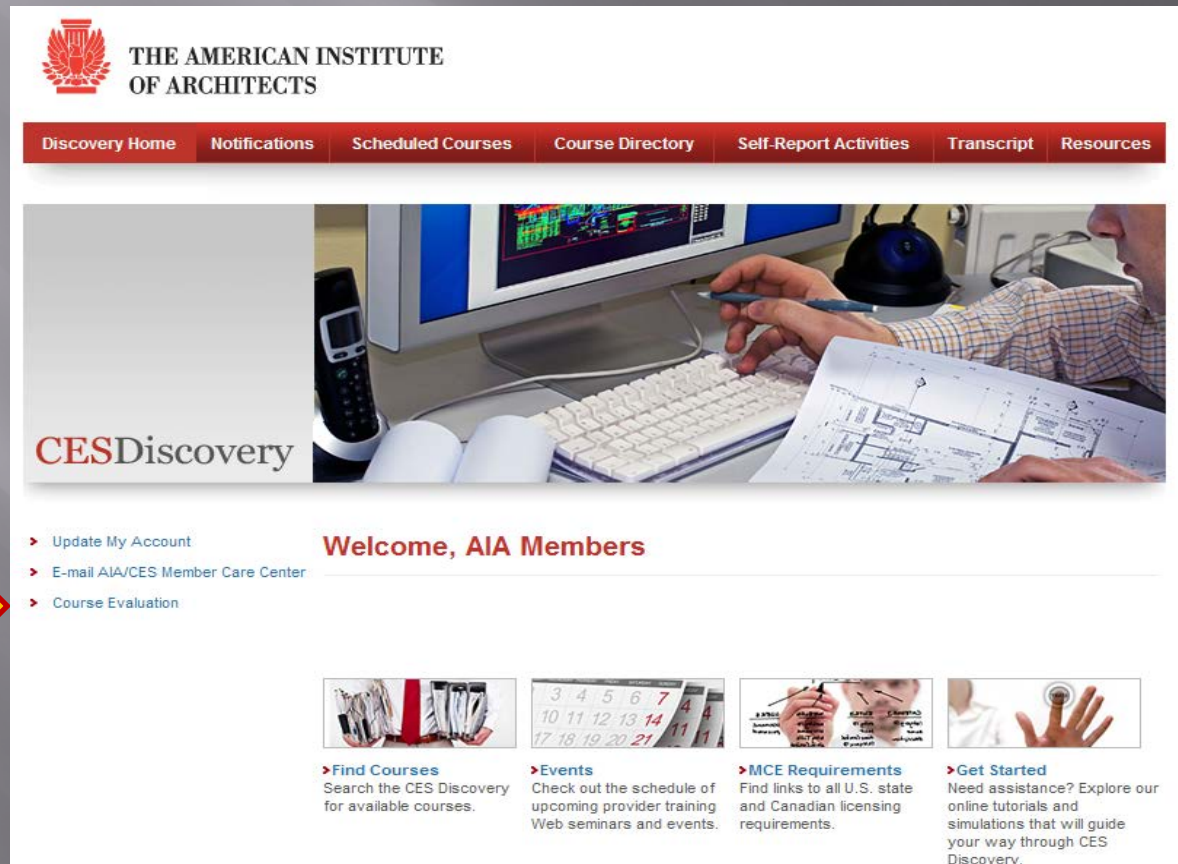
- Roof Access
- UFC 3-600-01, Section 2-9
- Three stories or more
- Then




- Enclosed exit stairs extending to top floor
- “Approved” hatch opening with “appropriate ladder”
- Minimum one stairway with standard door opening to roof surface


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**QUESTIONS??**

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