

WELCOME TO: ARCH 2330

BUILDING TECHNOLOGY III



GateWay Community College / SmithGroup JJR

Building Structure Systems

Lecture:

- Building Code, Fire Ratings and Assemblies
- Egress circulation
- Fire rated enclosures and wall types
- University plan layout

GateWay Community College / SmithGroup JJR



Phoenix, AZ

NYC Department of Buildings (DOB)

The DOB administers the city's construction codes, including the building code.

Other codes include:

The Fire, Plumbing, Fuel Gas and the Mechanical Codes

the codes can be accessed on the Internet at:

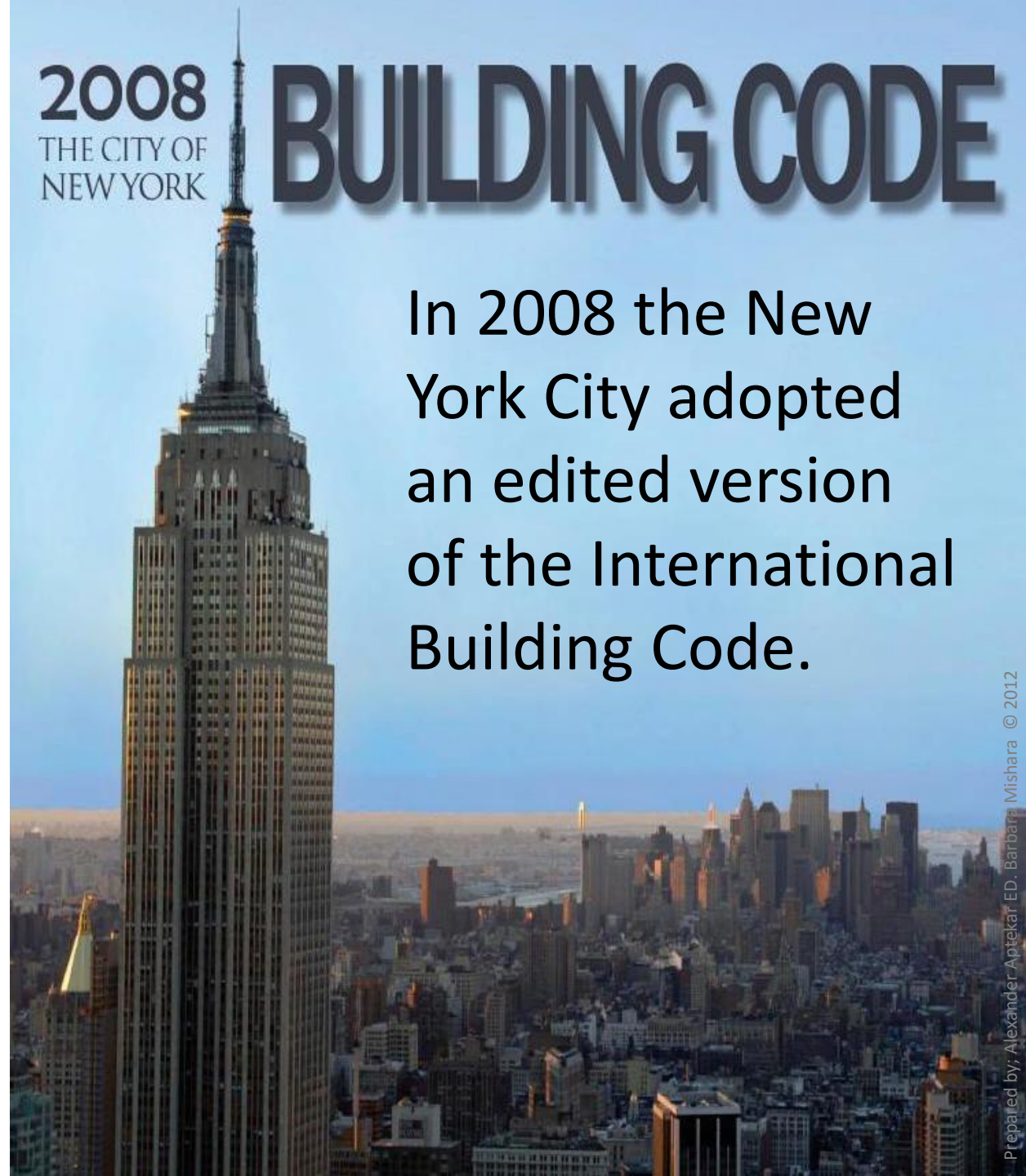
http://www.nyc.gov/html/dob/html/codes_and_reference_materials/reference.shtml

Or

<http://www2.iccsafe.org/states/newyorkcity/Building/Building-Frameset.html>

Building codes regulate construction and this is reflected in construction documents.

ARCH 2330 / 2430



The Building Code looks at these issues:

Occupancy types

Construction types

Building or floor area

Building height

Exits/ egress

Building separations and shafts

Fire protection

Fire extinguishing systems

Engineering requirements

NYC BUILDING CODE

Occupancy Groups



courtesy of PROF. Jason Montgomery

NYC BUILDING CODE

Occupancy Groups

<i>A</i>	<i>Assembly</i>
<i>B</i>	<i>Business</i>
<i>E</i>	<i>Educational</i>
<i>F</i>	<i>Industrial</i>
<i>H</i>	<i>High Hazard</i>
<i>I</i>	<i>Institutional</i>
<i>M</i>	<i>Mercantile</i>
<i>R</i>	<i>Residential</i>
<i>S</i>	<i>Storage</i>
<i>U</i>	<i>Utility Buildings</i>

Chapter 3 - Use and Occupancy Classification

SECTION BC 303 ASSEMBLY GROUP A

303.1 Assembly Group A. Assembly Group A occupancy includes, among others, the use of a building or structure or a portion thereof, excluding a dwelling unit, for the gathering together of any number of persons for purposes such as civic, social or religious functions, recreation, food or drink consumption, awaiting transportation, or similar group activities; or when occupied by 75 persons or more for educational or instructional purposes.

NYC BUILDING CODE

Exceptions:

1. A room or space used for assembly purposes by fewer than 75 persons and accessory to another occupancy shall be included as a part of that occupancy.
2. A building or non-accessory tenant space used for assembly purposes by fewer than 75 persons shall be considered a Group B occupancy.

Assembly occupancies shall include the following:

A-1

Assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures including, but not limited to:

Motion picture theaters

Symphony and concert halls

Television and radio studios admitting an audience

Theaters

Assembly occupancies shall include the following:

A-2

Assembly uses intended for food and/or drink consumption including, but not limited to:

Banquet halls

Cabarets

Cafeterias, except as provided for in A-3

Dance halls

Night clubs

Restaurants

Taverns and bars

Assembly occupancies shall include the following:

A-3

Assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A including, but not limited to:

- Amusement arcades
- Art galleries
- Bowling alleys
- Cafeterias for children up to and including the 12th grade
- Classrooms and instructional rooms with 75 persons or more; such rooms with fewer than 75 persons shall be classified as Group B or E
- Community halls
- Courtrooms

Assembly occupancies shall include the following:

A-4

Assembly uses intended for viewing of indoor sporting events and activities with spectator seating including, but not limited to:

- Arenas
- Skating rinks
- Swimming pools
- Tennis courts

A-5

Assembly uses intended for participation in or viewing outdoor activities including, but not limited to:

- Amusement park structures
- Bleachers
- Grandstands
- Stadiums

Building Codes

Construction Types

IA (most resistant)

IB

IIA

IIB

IIIA

IIIB

IV – Heavy Timber

VA

VB (least resistant)



Building Codes / Construction type

Protected "A" means that all structural members of a building has additional fire rated coating.

Un-protected "B" means that all structural members of a building or structure has no additional fire rated.

Types I and II fire-resistive

- noncombustible materials (concrete, masonry, steel)
- substantial fire-resistance ratings (up to 3hrs)
- differences:
 - type I --fewer height or area limits, but 2-3 hr. fire-resistance for structure;
 - type II -- substantially lower height limits; other limits on floor area and number of stories;
 - less fire resistance required for type II structures means less cost.

Building Codes / Construction type

Type II A & B

- noncombustible exterior walls (masonry or concrete)
- noncombustible structural materials;
- smaller floor areas, heights, number of stories allowed (mostly 4 stories allowed).
- Type II A 1-hour fire resistance throughout

Building Codes / Construction type

Type III A, B

- noncombustible exterior walls of masonry or concrete with anything else inside;
- similar limits as Type II A, B (since exterior walls have such a high f.r.-rating);
- was known as "ordinary" construction.

Building Codes / Construction type

Type IV

- noncombustible exterior walls of masonry or concrete with certain combustible materials inside;
- minimum dimensions on wood structure: 8" min. for columns; 6x10 minimum for beams;
- no concealed ceiling spaces, etc.
- was known as "heavy timber" construction.
- Can be used in roof construction where 1-hour fire-resistance (or less) is required.

Building Codes / Construction type

Type V

- basically light wood framing;
- greatest limitations on:
 - area, heights, etc. where permitted at all.

This is the typical single-family home construction method. These buildings are built with 2x4 or 2x6 studs and load bearing walls, wood floor trusses or wood floor joist and wood roof framing.

NYC BUILDING CODE

SECTION BC 503 GENERAL HEIGHT AND AREA LIMITATIONS

TABLE 503 ALLOWABLE
HEIGHT AND BUILDING
AREAS^a

Height limitations
shown as stories and
feet above grade plane.
Area limitations as
determined by the
definition of "Area,
building," per floor.

UL = Unlimited,
NP = Not permitted

GROUP	Hgt (feet) Hgt (S)	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
		UL	160 ^e	65	55	65	55	65	50	40
A-1	S A	UL UL	UL UL	6 17,500	3 10,500	6 14,700	3 5,600	6 15,000	3 8,400	2 5,500
A-2	S A	UL UL	UL UL	6 17,500	3 9,500	6 14,000	3 5,600	6 15,000	3 8,400	2 5,500
A-3	S A	UL UL	UL UL	6 17,500	3 9,500	6 14,000	3 5,600	6 15,000	3 8,400	2 5,500
A-4	S A	UL UL	UL UL	6 17,500	3 9,500	6 14,000	3 5,600	6 15,000	3 8,400	2 5,500
A-5	S A	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	6 UL	UL UL	UL UL
B	S A	UL UL	UL UL	6 37,500	3 10,500	6 28,500	3 5,600	6 36,000	3 8,400	2 5,500
E	S A	UL UL	UL UL	4 26,000	3 10,500	4 23,500	3 5,600	6 25,500	3 8,400	2 5,500
F-1	S A	UL UL	6 UL	5 12,500	3 7,500	5 7,500	2 3,000	5 10,000	3 3,000	2 1,000
F-2	S A	UL	UL	6	3	6	3	6	3	2
H-1	S A	<div>Protected "A" means that all structural members of a building <u>has additional</u> fire rated coating.</div> <div>Un-protected "B" means that all structural members of a building or structure has <u>no additional</u> fire rated.</div>								
H-2 ^d	S A									
H-3 ^d	S A									
H-4	S A									
H-5	S A									
I-1	S A									
I-2	S A	UL UL	6 UL	4 7,000	4 3,500	5 5,000	3 1,200	5 6,500	3 2,000	NP NP
I-3	S A	UL UL	4 UL	4 7,000	3 3,500	4 5,000	2 1,200	4 6,500	3 2,000	NP NP
I-4	S A	UL UL	UL UL	3 26,500	3 9,500	3 23,500	3 5,600	3 25,500	2 8,400	2 5,500
M	S A	UL UL	UL UL	6 21,500	3 7,500	6 18,500	3 5,600	6 14,000	3 8,400	2 5,500

NYC BUILDING CODE

TABLE 508.3.3 REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

USE	A-1	A-2	A-3	A-4	A-5	B ^b	E	F-1	F-2	H-1	H-2	H-3	H-4
A-1	—	2	2	2	2	2	2	3	2	NP	4	3	2
A-2 ^e	—	—	2	2	2	2	2	3	2	NP	4	3	2
A-3	—	—	—	2	2	2	2	3	2	NP	4	3	2
A-4	—	—	—	—	2	2	2	3	2	NP	4	3	2
A-5	—	—	—	—	—	2	2	3	2	NP	4	3	2
B ^b	—	—	—	—	—	—	2	3	2	NP	2	1	1
E	—	—	—	—	—	—	—	3	2	NP	4	3	2
F-1	—	—	—	—	—	—	—	—	3	NP	2	1	1
F-2	—	—	—	—	—	—	—	—	—	NP	2	1	1
H-1	—	—	—	—	—	—	—	—	—	—	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	1	2
H-3	—	—	—	—	—	—	—	—	—	—	—	—	1
H-4	—	—	—	—	—	—	—	—	—	—	—	—	—
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—
I-1	—	—	—	—	—	—	—	—	—	—	—	—	—

508.3.3 Separated occupancies. Buildings or portions of buildings that comply with the provisions of this section shall qualify as separated occupancies.

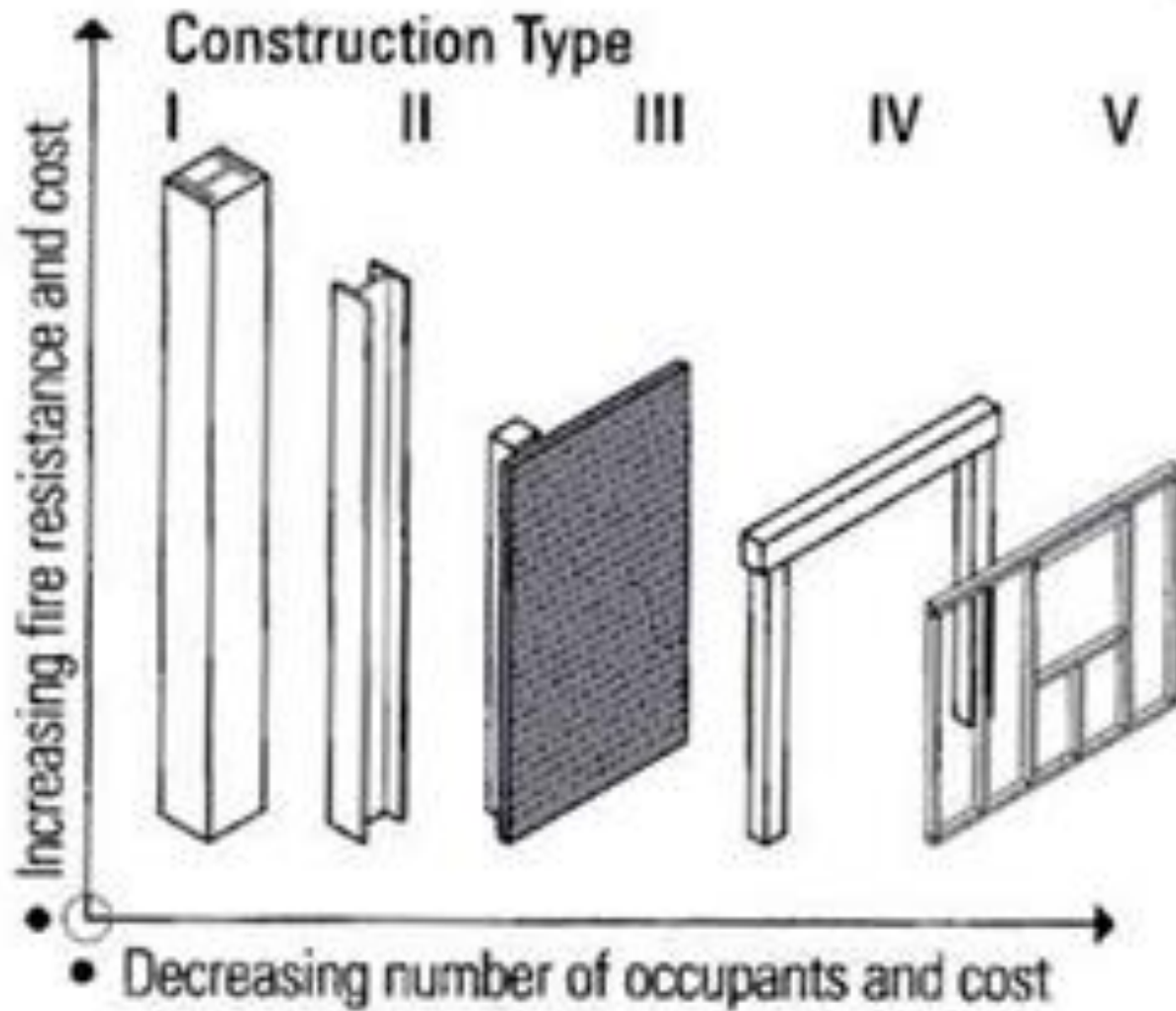
NYC BUILDING CODE

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

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V ⁱ	
	A	B	A ^d	B	A ^d	B	HT	A ^d	B
Structural frame ^a Including columns, girders, trusses	3 ^b	2 ^b	1	0	1	0	HT	1	0
Bearing walls									
Exterior ^{f,g}	3	2	1	0	2	2	2	1	0
Interior	3 ^b	2 ^b	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions			See Table 602						
Exterior									
Nonbearing walls and partitions									
Interior ^e	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction ^h Including supporting beams and joists	2	2	1	0	1	0	HT	1	0
Roof construction Including supporting beams and joists	1 ^{1/2} ^c	1 ^c	1 ^c	0 ^c	1 ^c	0	HT	1 ^c	0

- a. The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof panels which have no connection to the columns shall be considered secondary members and not a part of the structural frame.
- b. Roof supports: Fire-resistance ratings of structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.

NYC BUILDING CODE

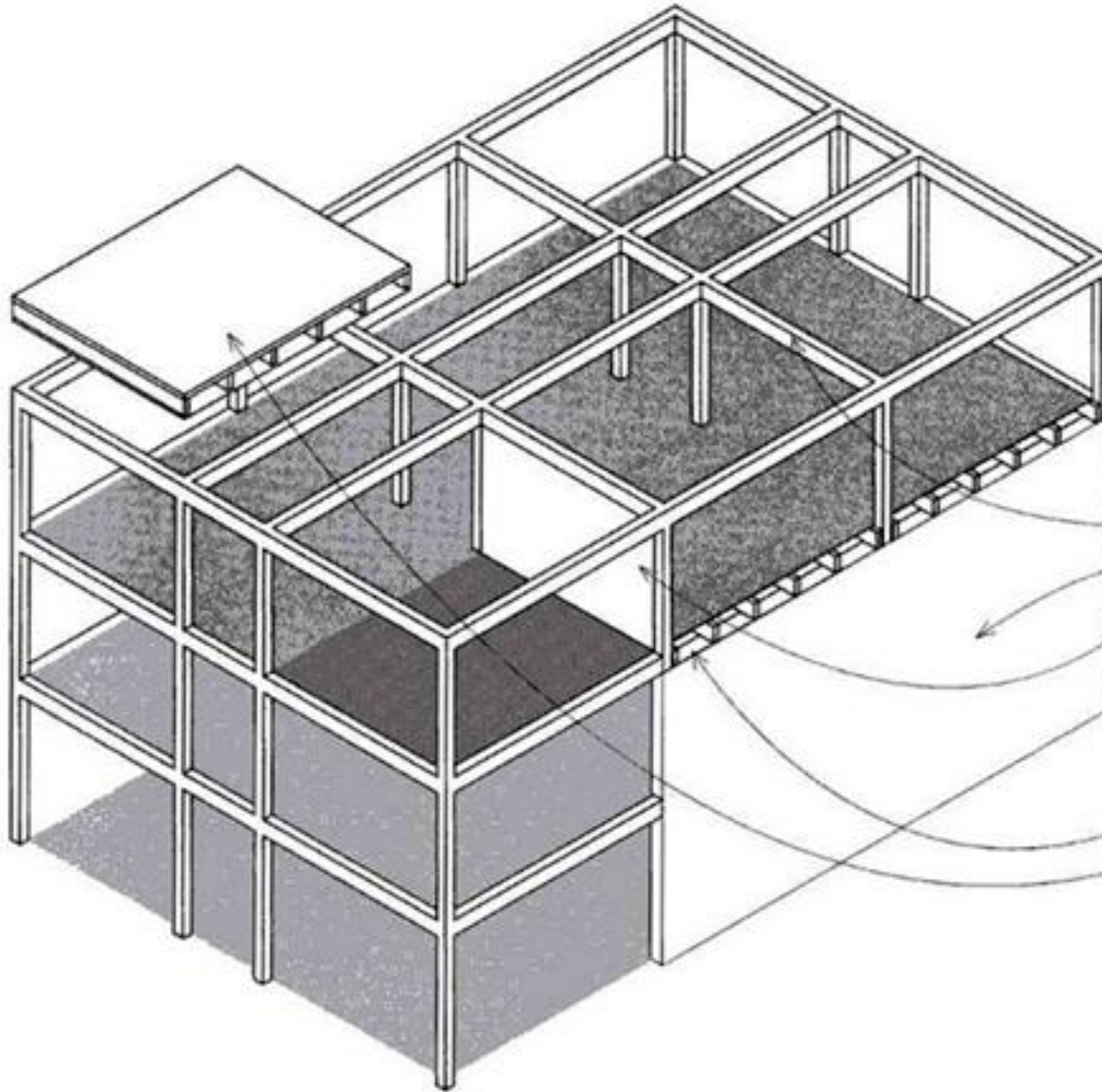


GateWay Community College / SmithGroup JJR



Phoenix, AZ

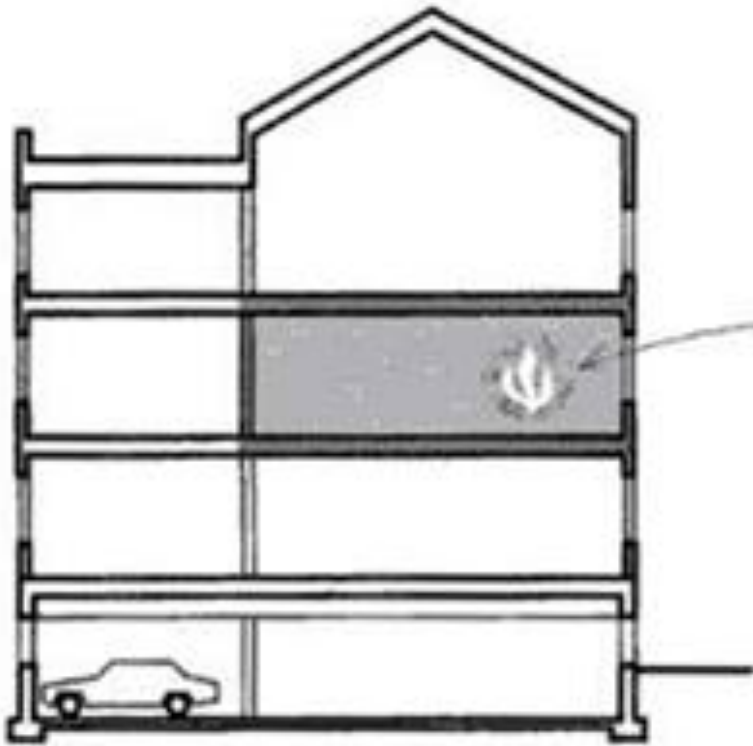
NYC BUILDING CODE



- Table 601 specifies the required fire-resistance ratings of major building elements for the five types of construction. The fire-resistance of building elements gives occupants time to leave the building in the event of an emergency and allows firefighters time to fight the fire by retarding structural failure for a designated time period. The categories of building elements are:

- Structural frame
- Bearing walls
- Nonbearing wall requirements are noted in § 602, Table 601 and Table 602. Interior nonbearing wall and partition requirements are per Table 601. Exterior nonbearing wall requirements are per Table 602.
- Floor construction
- Roof construction

SEPARATION OF DIFFERENT OCCUPANCIES

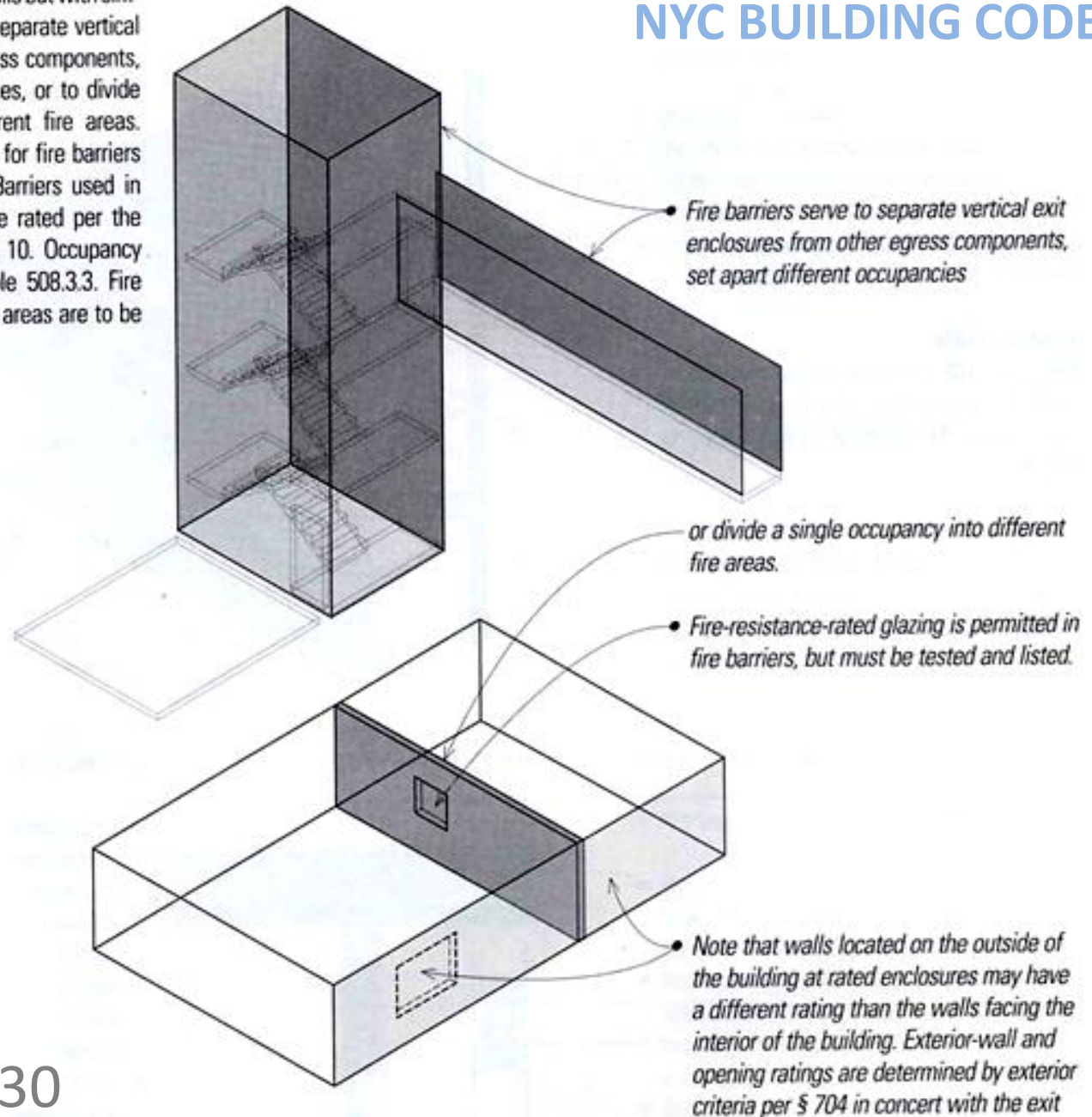


- *The requirements for the fire-resistance of internal building elements are based on the theory of compartmentalization. The idea is to divide a building into distinct zones with barriers to retard the propagation and spread of fire.*

FIRE BARRIERS

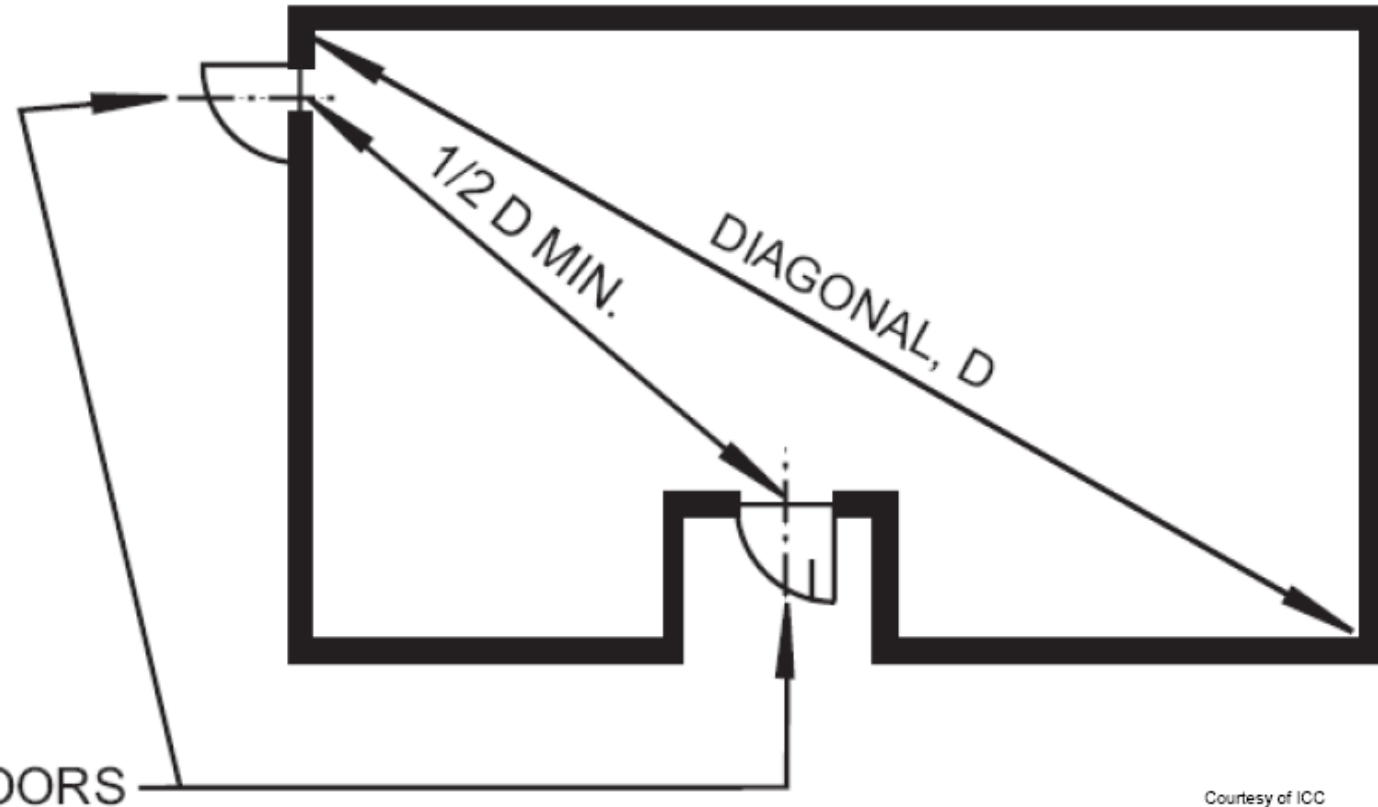
Fire barriers are similar to fire walls but with simpler criteria. They are used to separate vertical exit enclosures from other egress components, to separate different occupancies, or to divide a single occupancy into different fire areas. Required fire-resistance ratings for fire barriers are determined by their use. Barriers used in means of egress protection are rated per the applicable sections in Chapter 10. Occupancy separation ratings are per Table 508.3.3. Fire resistance ratings between fire areas are to be per Table 706.3.9.

NYC BUILDING CODE



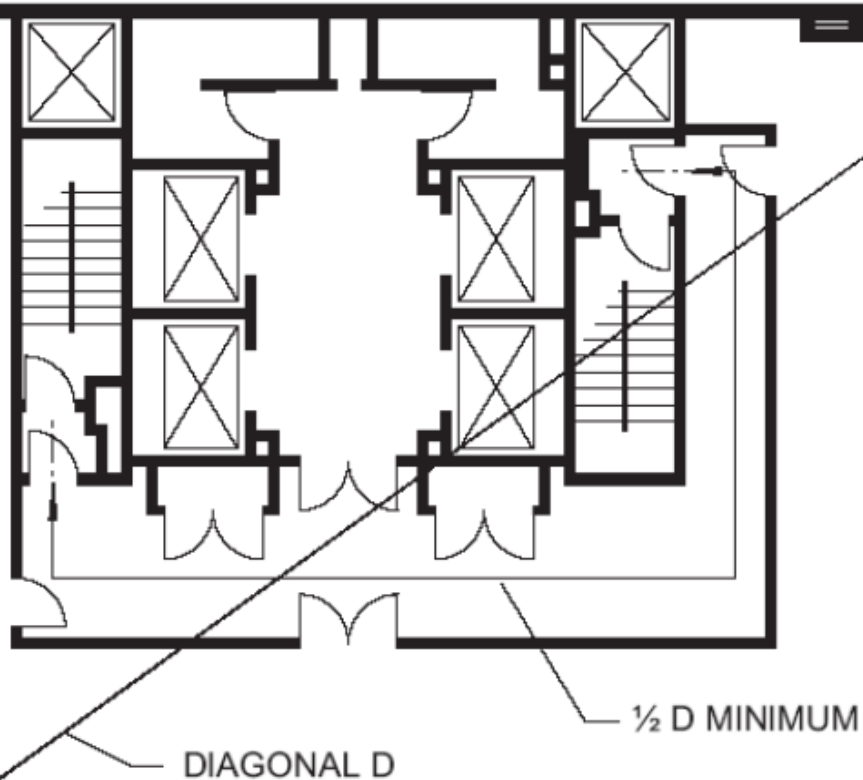
Exit or Exit Access Doorway Arrangement (1014.2.1)

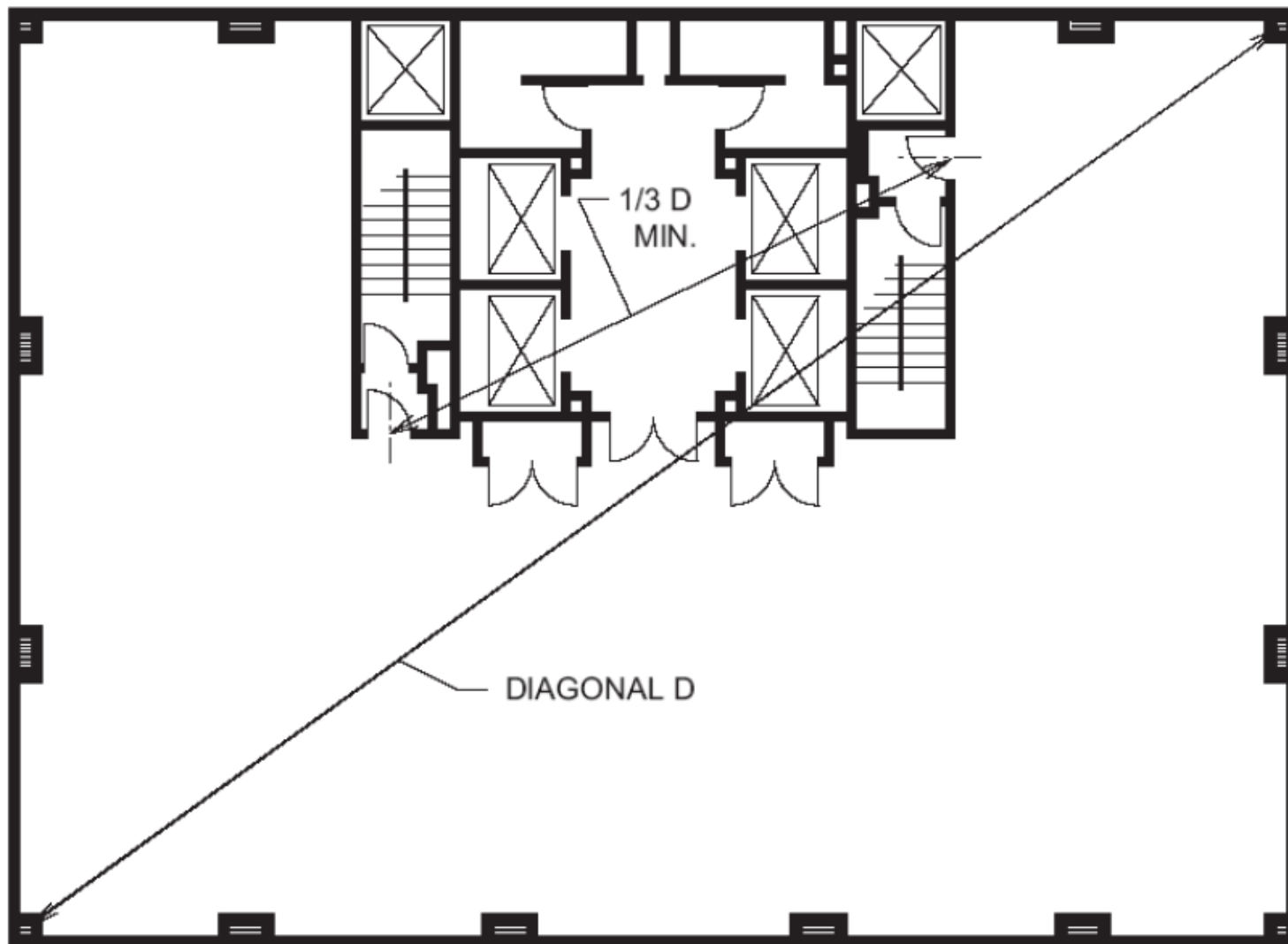
- Separation required to ensure that not all exits are compromised:



Courtesy of ICC

**(1014.2.1
Exception
1)** Where 1-
hr-rated
corridor is
provided,
measurement
is along the
shortest direct
line of travel
within the
corridor

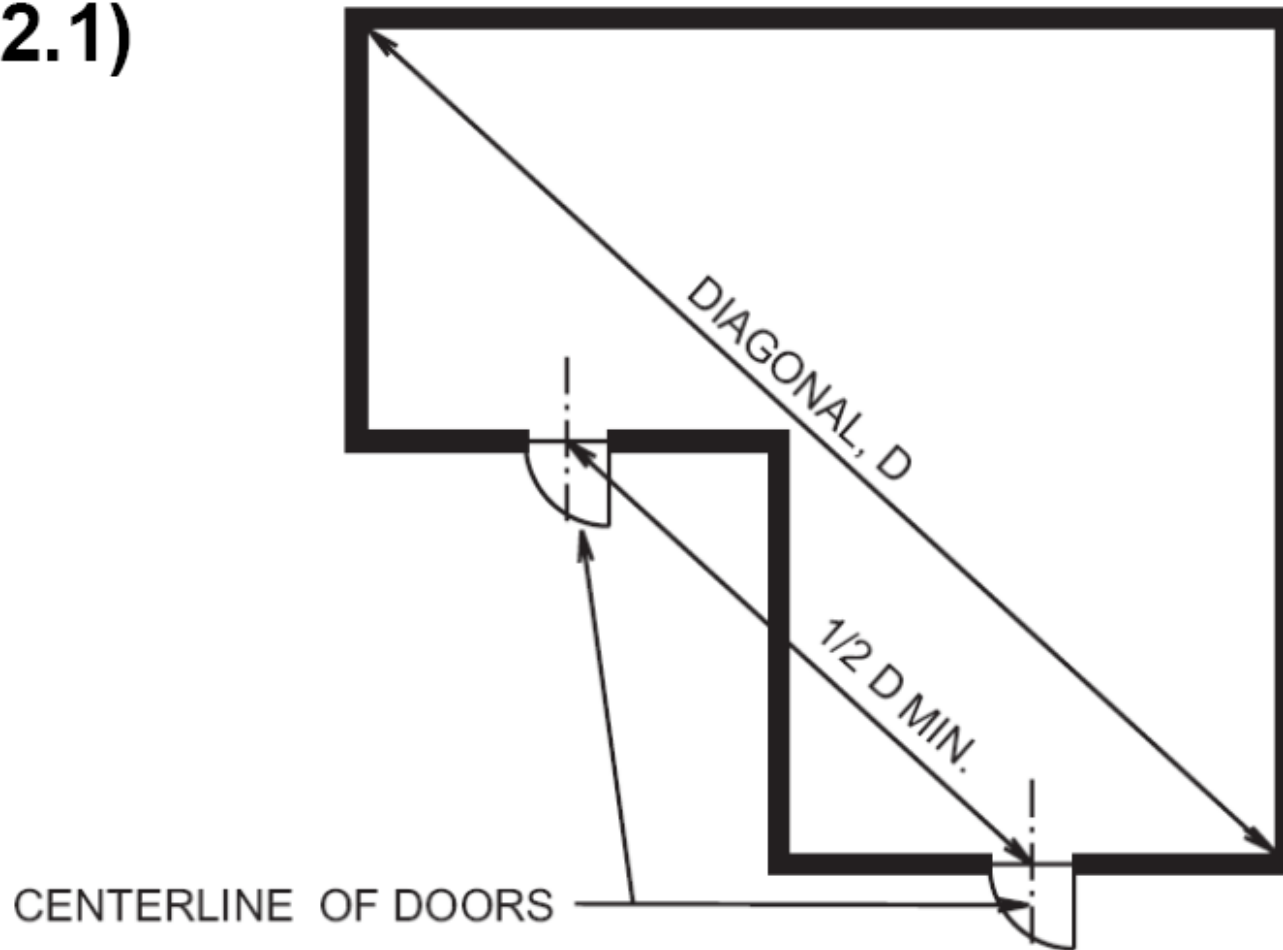




(1014.2.1
Exception
2) In
sprinklered
buildings,
the
separation
distance can
be reduced
to 1/3

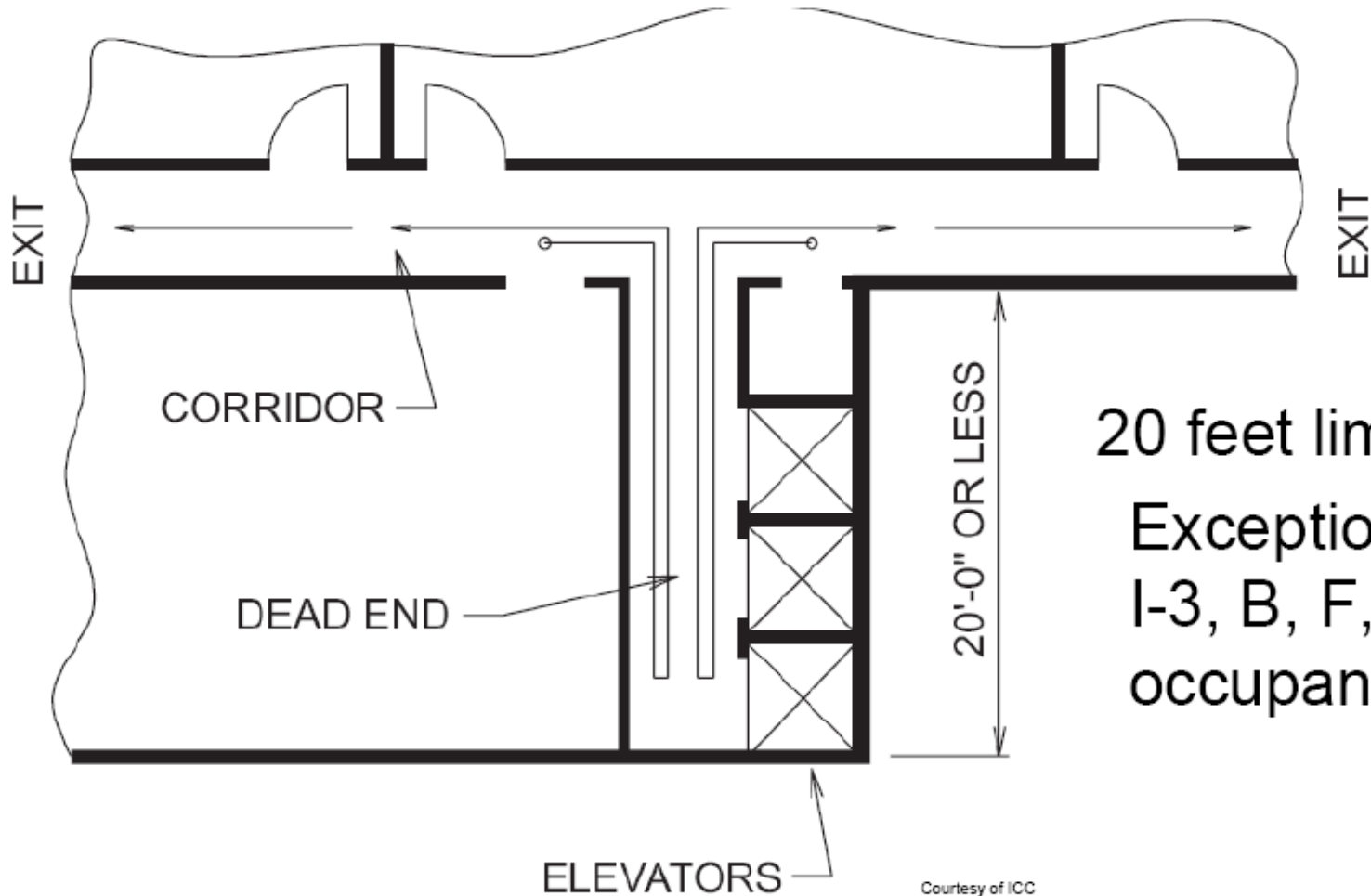
Measurement in a Straight Line between doors

(1014.2.1)



Courtesy of ICC

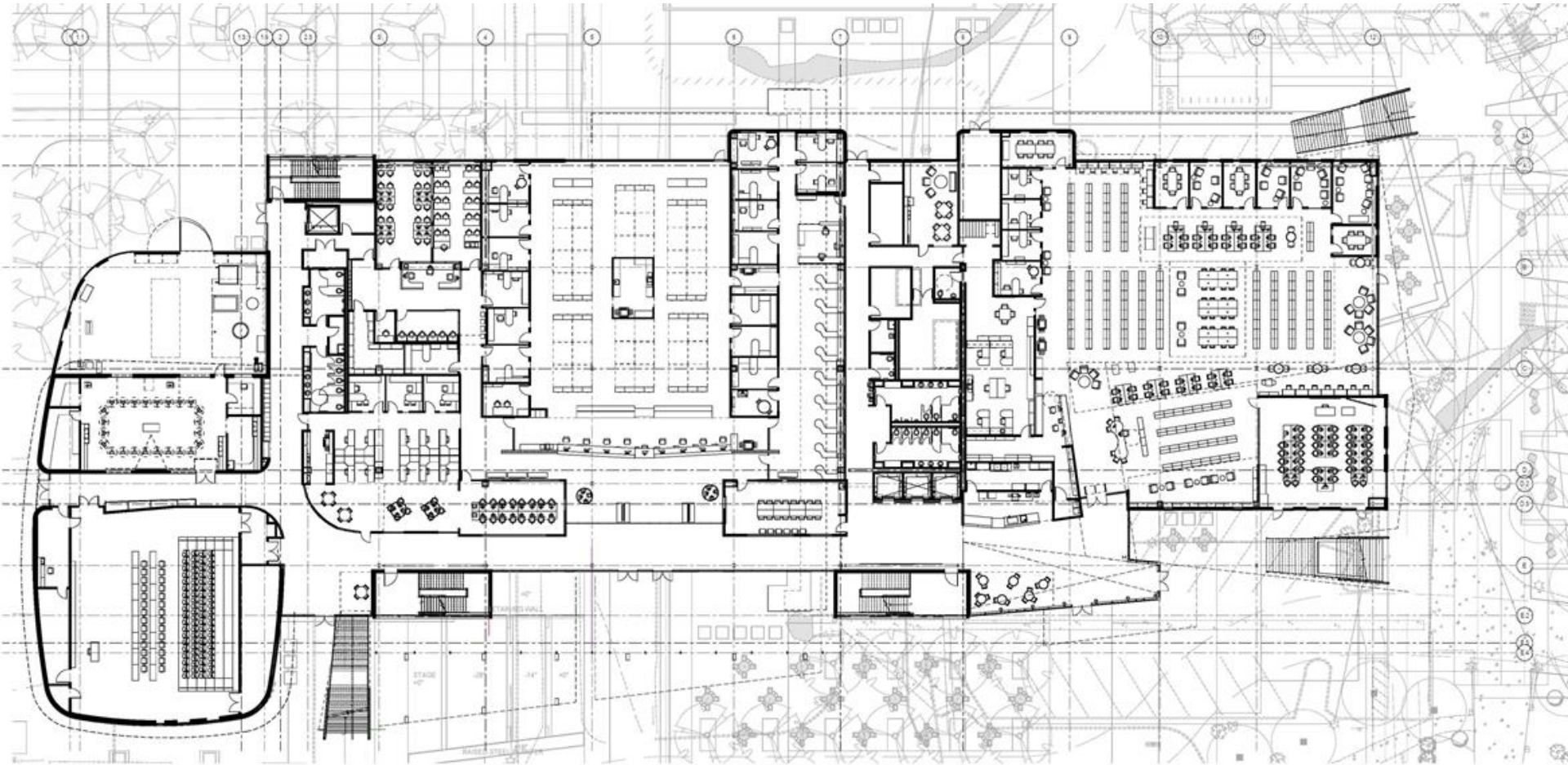
Dead Ends (1016.3)



20 feet limit in general
Exceptions for certain
I-3, B, F, and R-2
occupancies

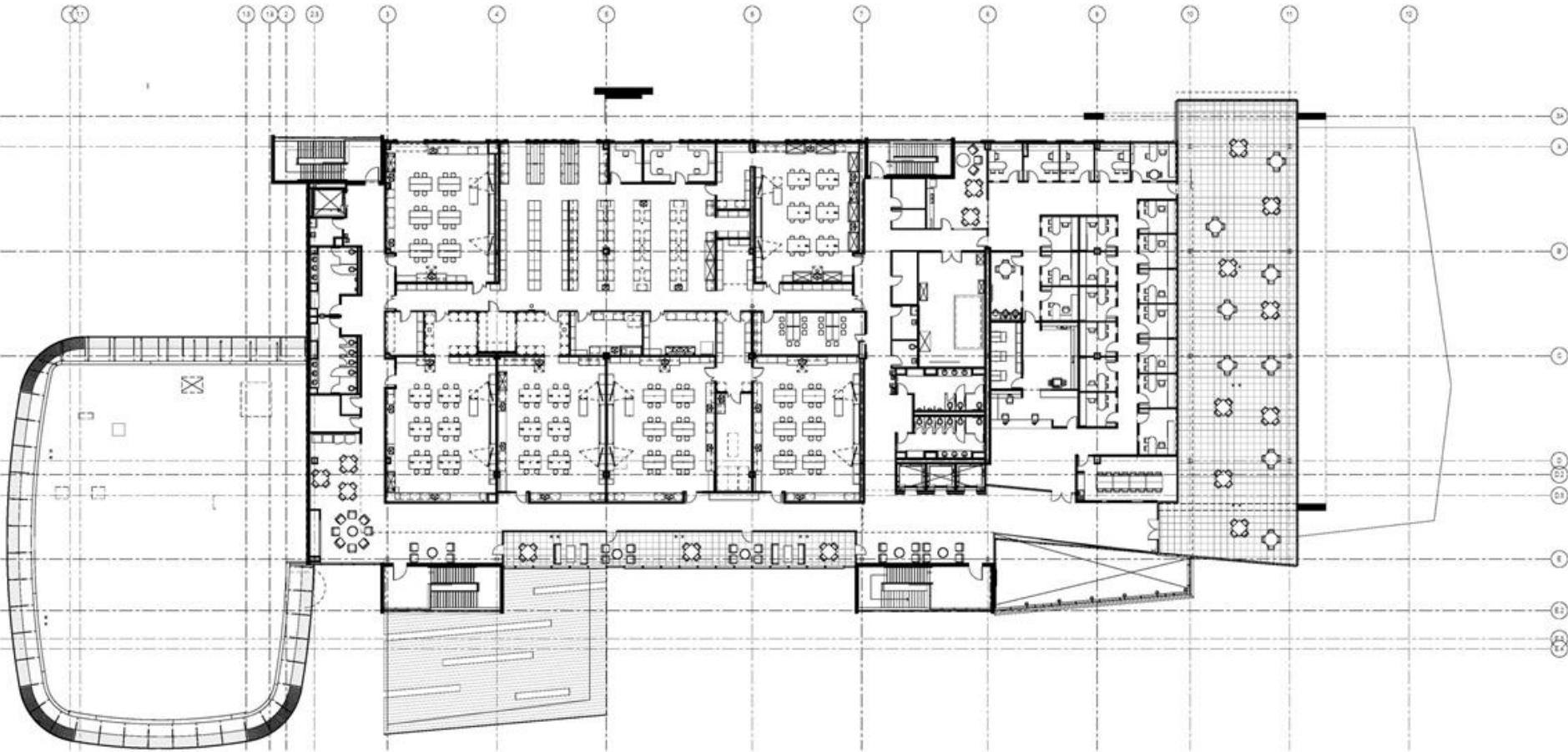
Courtesy of ICC

GateWay Community College / SmithGroup JJR



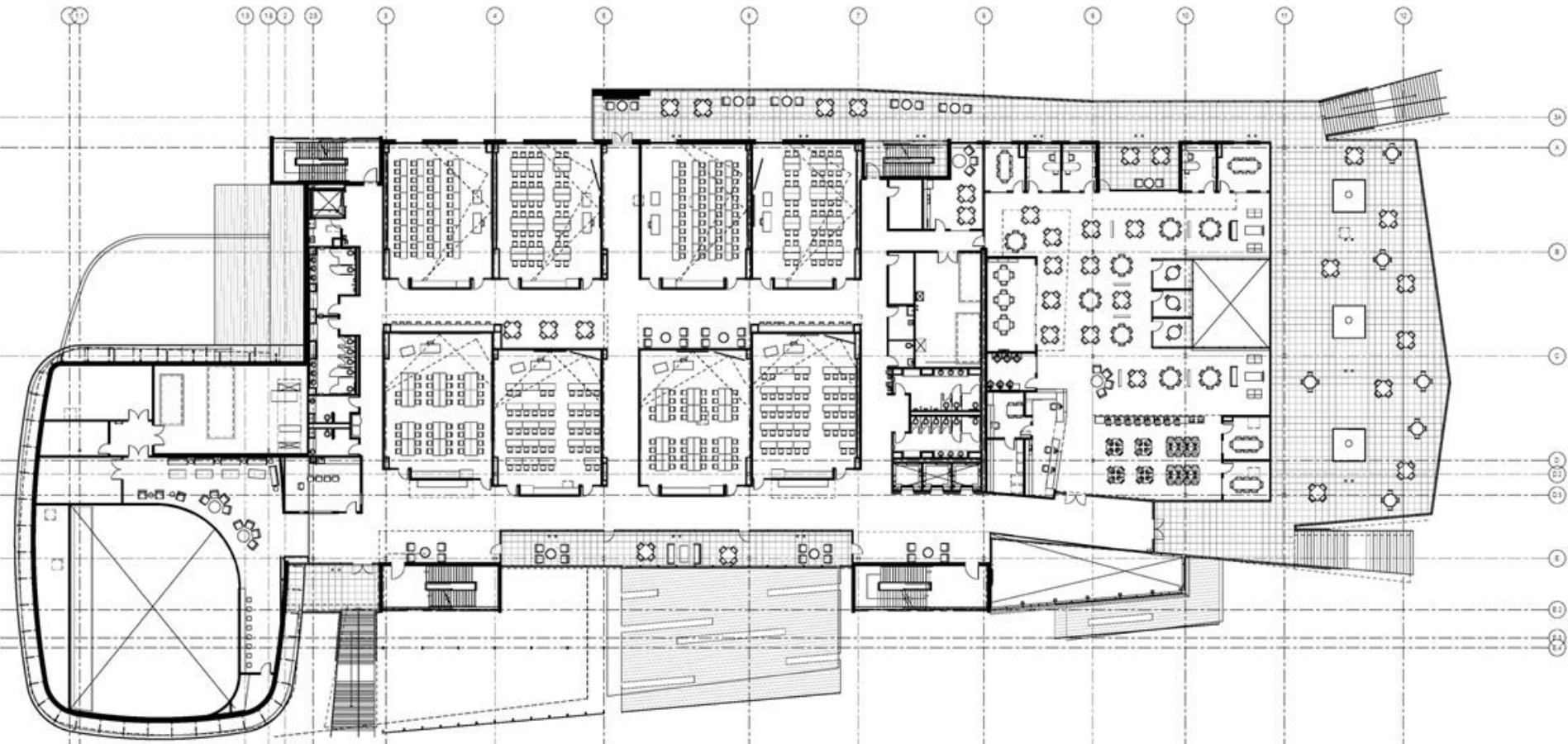
Phoenix, AZ

GateWay Community College / SmithGroup JJR



Phoenix, AZ

GateWay Community College / SmithGroup JJR



Phoenix, AZ

TABLE 1015.1
EXIT ACCESS TRAVEL DISTANCE^a

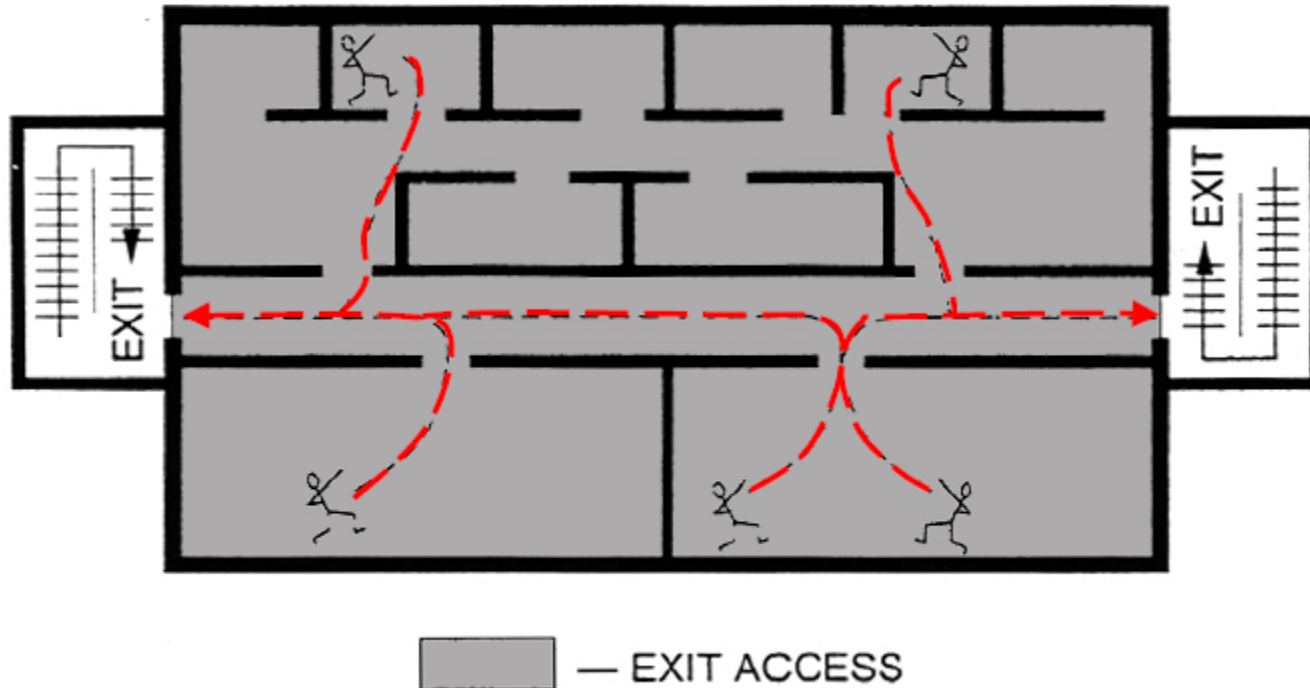
<u>OCCUPANCY</u>	<u>WITHOUT SPRINKLER SYSTEM (feet)</u>	<u>WITH SPRINKLER SYSTEM (feet)</u>
<u>A</u>	<u>See Section 1024.7</u>	
<u>E, F-1, I-1, M, R, S-1</u>	<u>150</u>	<u>200^b</u>
<u>B</u>	<u>200</u>	<u>300^c</u>
<u>F-2, S-2, U</u>	<u>200</u>	<u>250^b</u>
<u>H-1</u>	<u>Not permitted</u>	<u>75^c</u>
<u>H-2</u>	<u>Not permitted</u>	<u>100^c</u>
<u>H-3</u>	<u>Not permitted</u>	<u>150^c</u>
<u>H-4</u>	<u>Not permitted</u>	<u>175^c</u>
<u>H-5</u>	<u>Not permitted</u>	<u>200^c</u>
<u>I-2, I-3, I-4</u>	<u>150</u>	<u>200^c</u>

For SI: 1 foot = 304.8 mm

- a. See the following sections for modifications to exit access travel distance requirements:
Section 402: For the distance limitation in malls.
Section 404: For the distance limitation through an atrium space.
Section 1018.2: For buildings with one exit.
Chapter 31: For the limitation in temporary structures.
- b. 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 sprinkler systems according to Section 903.3.1.2 are permitted.
- c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

Exit access (1013)

- Begins at the furthest occupied point in a room and ends at the entrance to an *exit*
- The travel distance is regulated



Courtesy of ICC

GateWay Community College / SmithGroup JJR

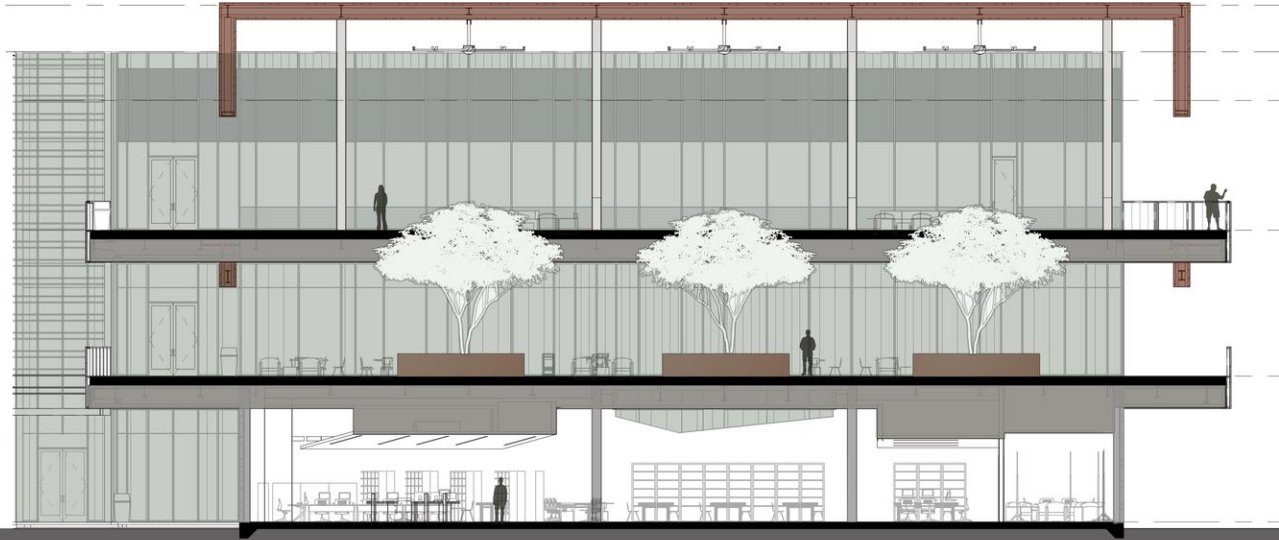


Phoenix, AZ



photo © Sam Frederick

GateWay Community College / SmithGroup JJR



Phoenix, AZ

GateWay Community College / SmithGroup JJR



Phoenix, AZ