Taking the Guesswork out of Mixed-Use Building Analysis

June 9, 2026 & June 10, 2026

Presented by:

Shannon A. Williams, PE, WoodWorks

Image: The Fowler, Holst Architecture, Axiom Engineers, photo Gabe Border

What is Mixed Use?

Warehouse Artist Lofts / Applied Architecture / Nicholas Wray

Granville1500 / Lorcan O'Herlihy Architects [LOHA] / Labib Funk + Associates / Photo Here and Now Agency

1430 Q / The HR Group Architects / Buehler Engineering / Greg Folkins Photography

Mixed-use development:

A type of urban development that blends residential, commercial, cultural, institutional, or industrial uses, where those functions are physically and functionally integrated, and that provides pedestrian connections.

Or, simplistically…..

Thomas Logan / Pivot North Architects / Axiom / Chad Case Visuals

A building with more than one occupancy group or intended function

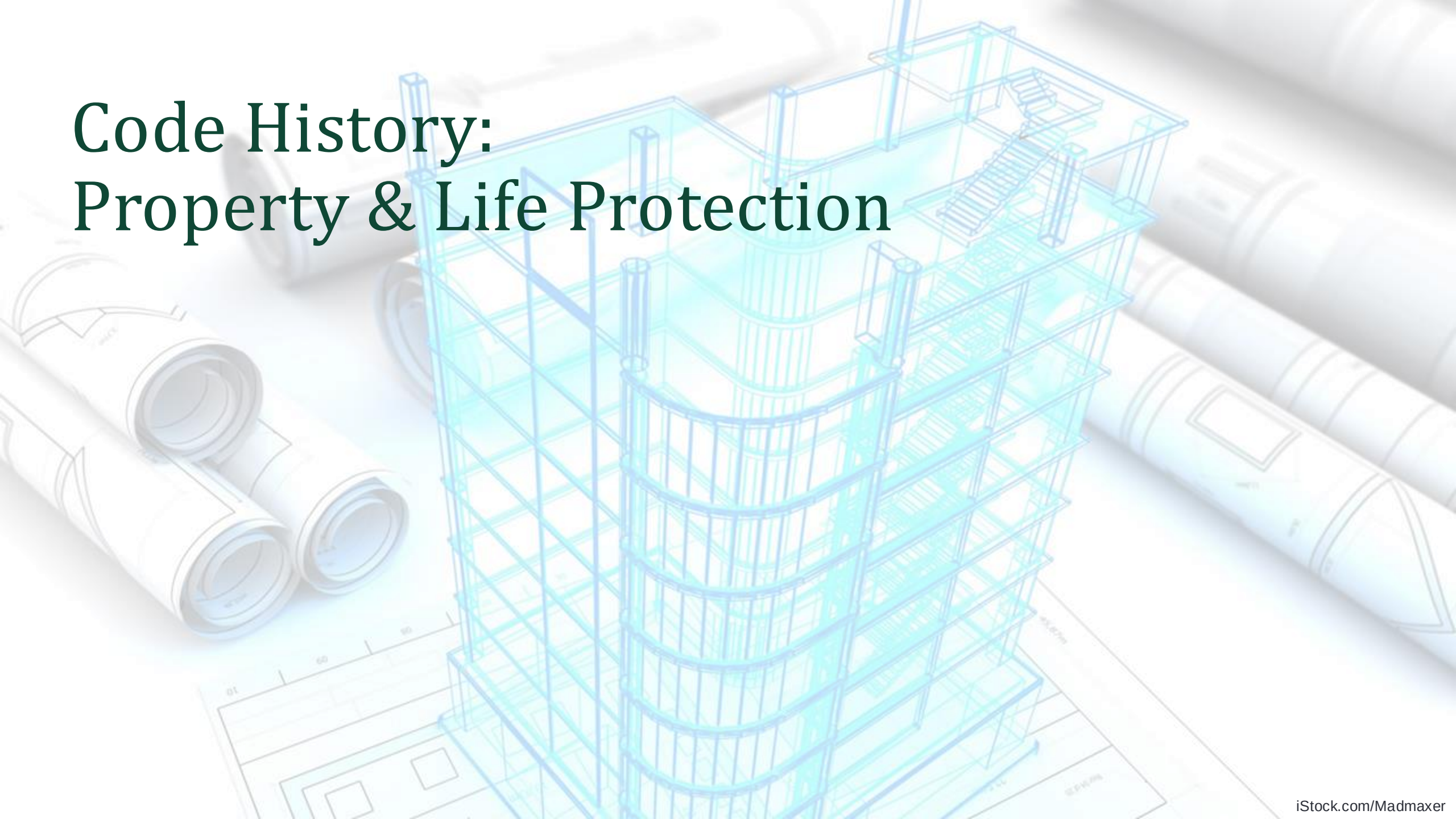
Stella / DesignARC / Taylor and Syfan /
Photo Lawrence Anderson/Esto

Agenda

- Code history
- Occupancy groups and construction types
- Mixed use buildings
- Building configuration options
  - Achieving fire separation (when necessary)
- Design examples

Marselle Condominiums / PB Architects / Yu & Trochalakis / Matt Todd Photography

Code History:
Property & Life Protection



iStock.com/Madmaxer

Fire and Life Safety in the Code

Early years:

- Reasonable level of property protection from fire
- Protected property
  = Protected occupants

Fire and Life Safety in the Code

Equivalent risk: Determine acceptable level of risk

- Varies by building
- Based on type of occupancy
- Limits on building size
  - Varies by construction type

Fire and Life Safety in the Code

Equivalent risk considerations:

- Fire hazard level
  - Based on building's use
- Limiting fire hazard
  - Restricting floor area / building height
- Building materials
  - Fire resistance provided by structure and finishes

iStock.com/porcorex

Fire and Life Safety in the Code

Modern building codes:

- More comprehensive & complex
  - Extensive research
  - Advancements in fire technology
- Life safety the primary fire concern

Fire and Life Safety in the Code

Minimum provisions for life safety:

- Fire detection, notification, suppression systems
- Adequate means of egress
- Limit fire spread
- Structural fire resistance
- Prevention of smoke migration

Fire and Life Safety in the Code

Fire detection, notification, suppression systems

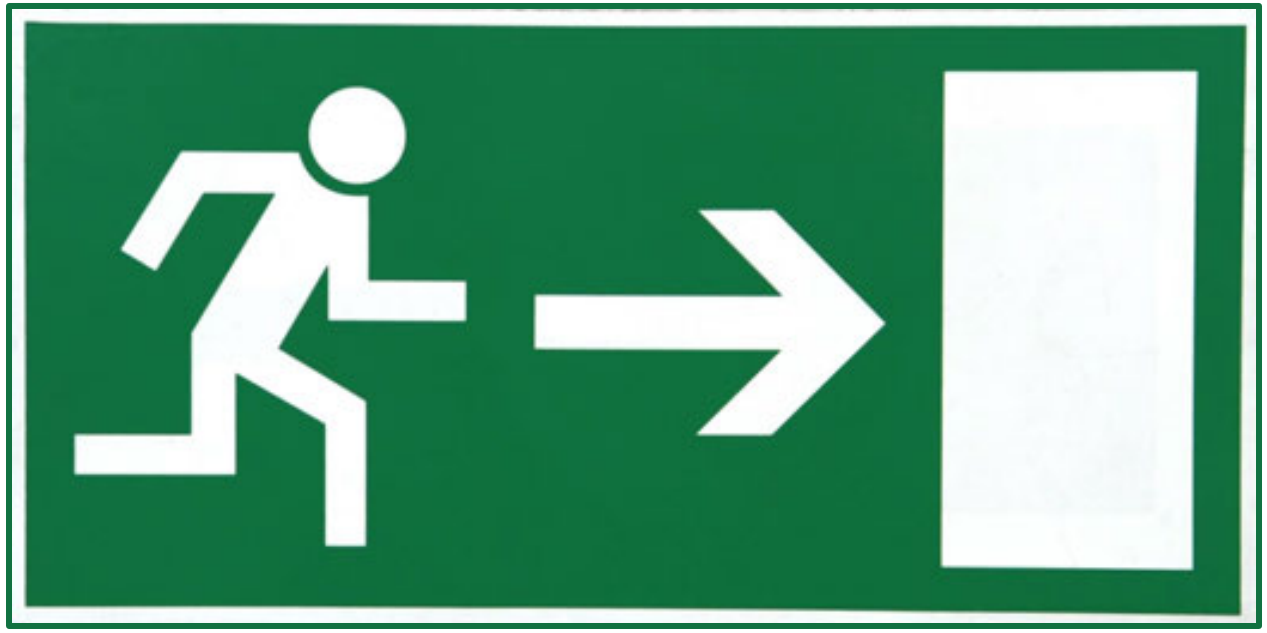
- Detection and notification
  - Smoke and fire alarms
- Suppression
  - Active fire protection (e.g. sprinklers)

Fire and Life Safety in the Code

Adequate means of egress

- Exits: Number, sizing, distance
- Operation and availability of components
- Exit signage
- Protection of exit paths

Note: Different occupancy groups may require different time to exit



iStock.com/LordRunar

Fire and Life Safety in the Code

Limit fire spread

- Extent of fire spread within building
  - Room to room
  - Level to level
- Adjacent buildings
  - Radiant heat exposure

Fire and Life Safety in the Code

Structural fire resistance

- Maintain structural integrity of building
- Account for response / participation of building

Table 601 (IBC 2021):

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	A	B	C	HT	A	B
Primary structural frame[f] (see Section 202)	3[a, b]	2[a, b, c]	1[b, c]	0[c]	1[b, c]	0	3[a]	2[a]	2[a]	HT	1[b, c]	0
Bearing walls												
Exterior[e, f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1 1/2[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	1 1/2	1	1	HT	1[b,c]	0

2021 International Building Code

Fire and Life Safety in the Code

Current building codes:

- Control building size
- Regulate allowed materials
- Stipulate fire resistance

Fire and Life Safety in the Code

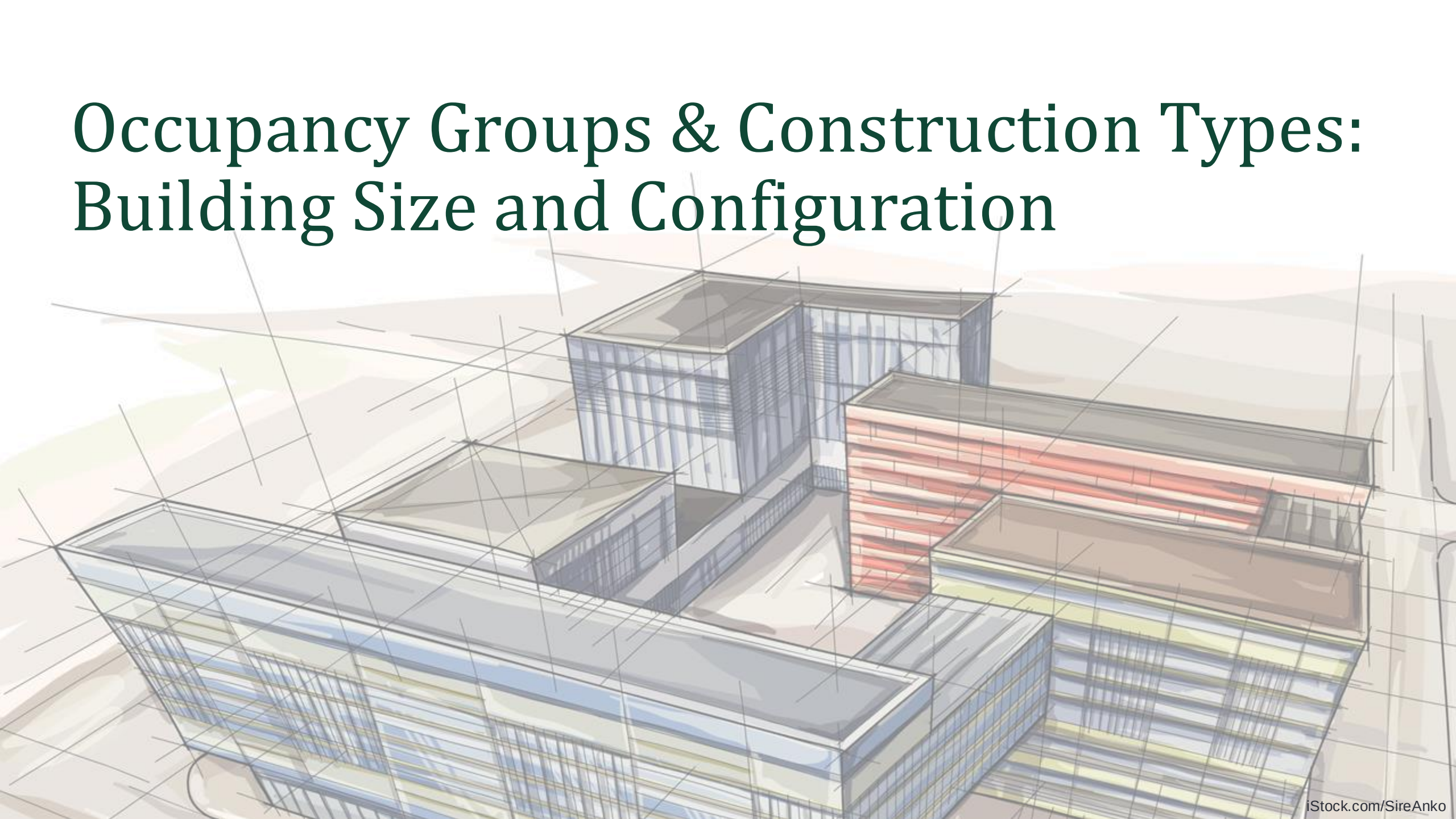
Current building codes:

- Control building size
- Regulate allowed materials
- Stipulate fire resistance

BUT the code still allows flexibility

- Configuration
- Construction type
- Materials
- Other choices

Occupancy Groups & Construction Types: Building Size and Configuration



iStock.com/SireAnko

Building Configuration Options

Multiple ways to classify a building!

- Challenge tradition: Consider all options to achieve the most cost-effective solution

The Distillery / ICON Architecture / Trent Bell Photography

Building Configuration:

Start with the **lowest common denominator** option, then work up

Don’t assume construction type, separation requirements, etc. based on materials, occupancy, etc.

District Flats – Charlotte NC / Studio Fusion / Larry Harwell

Building Configuration Options

Many buildings use higher construction types than necessary

- Traditional practice
- Cost impacts
  - Fire ratings
  - Material requirements

Crescent Terminus / Crescent Communities / Lor Aeck Sargent / SCA Consulting Engineers / Richar Lubrant

Building Configuration Options

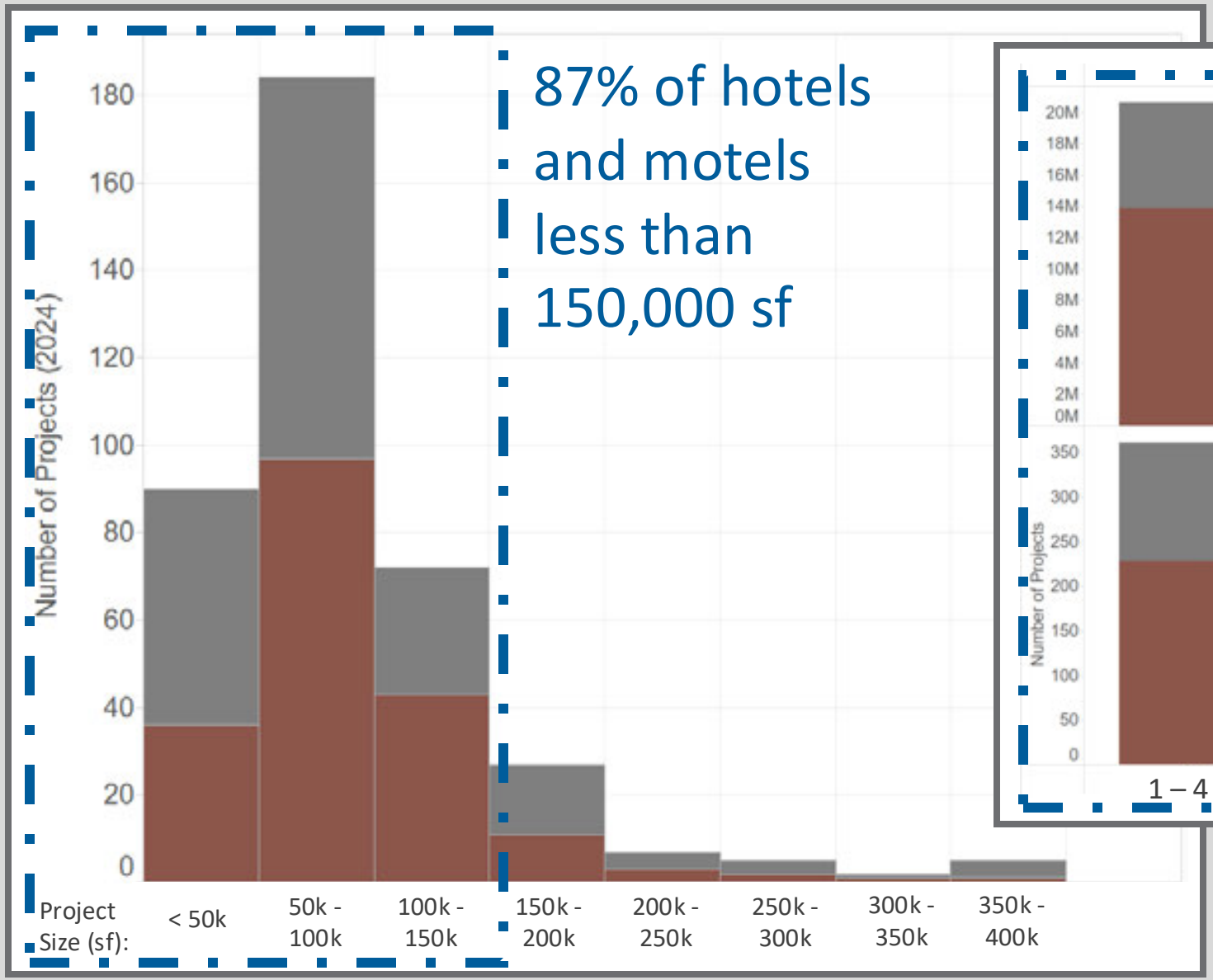
Many commercial occupancies can be framed with wood!

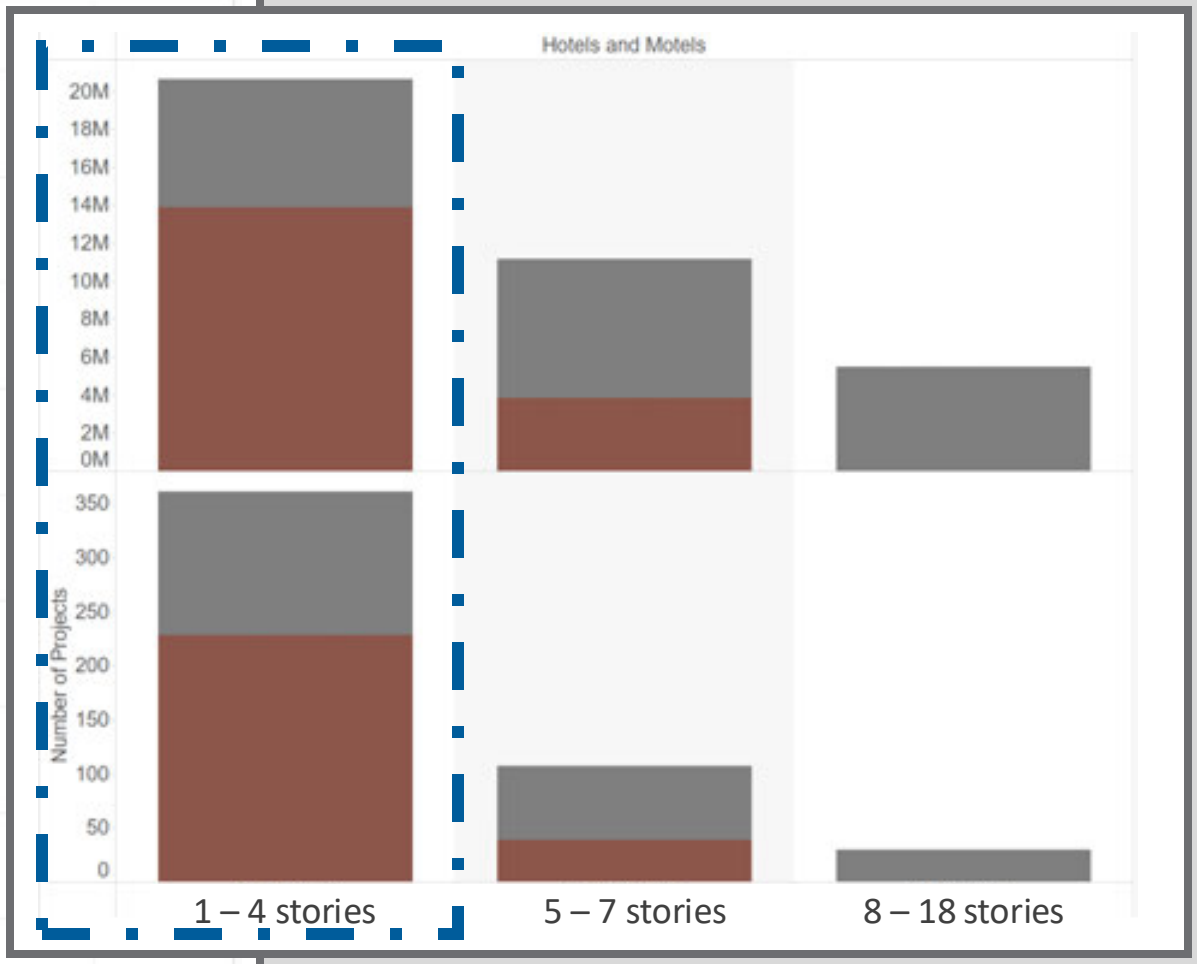
- Hotels
- Multi-family
- Office
- Retail
- Restaurants
- AND Mixed-use

Stella / DesignARC / Taylor and Syfan / Photo GLJ Partners

Market Data Analysis

Hotels and Motels: Average Building Size

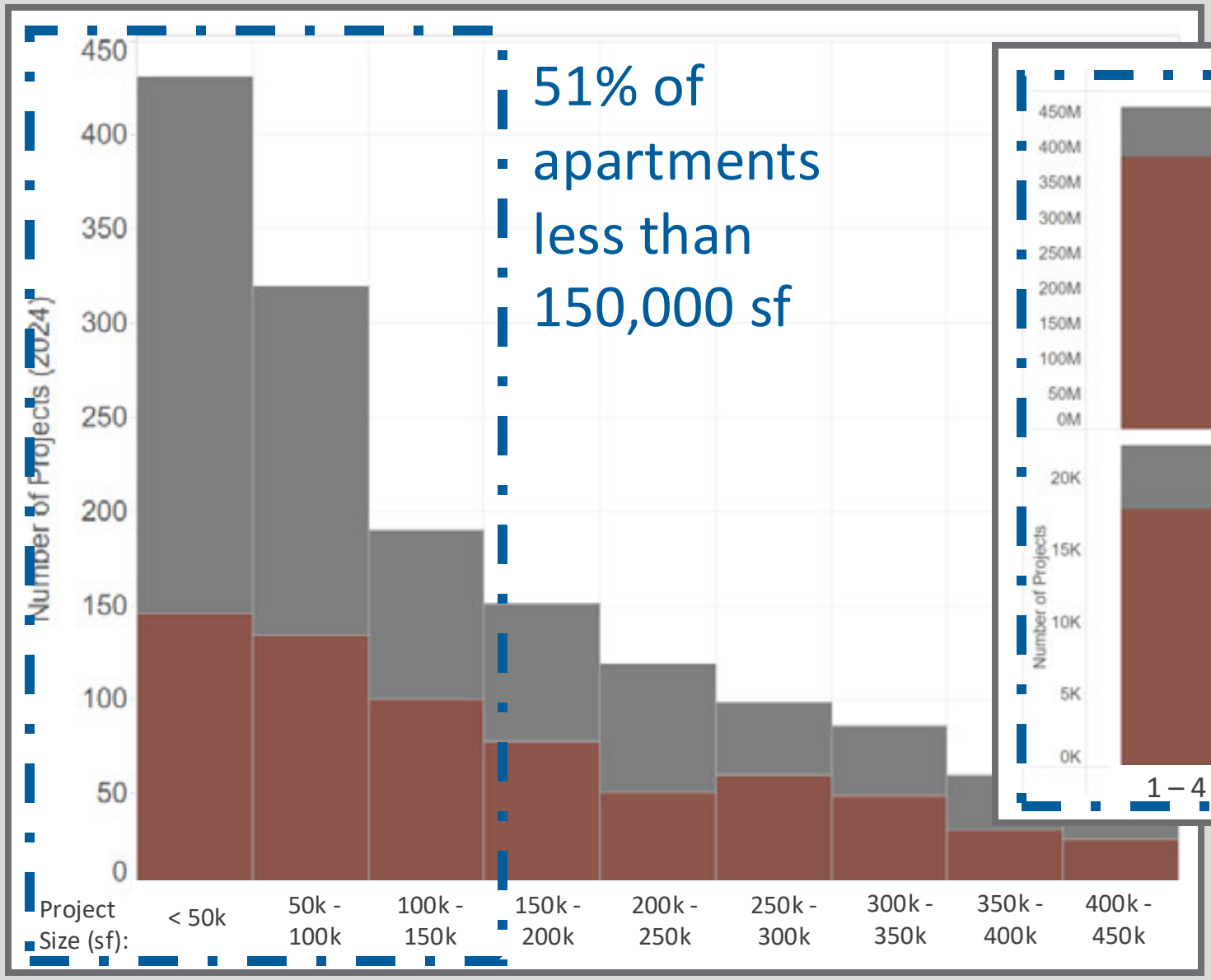




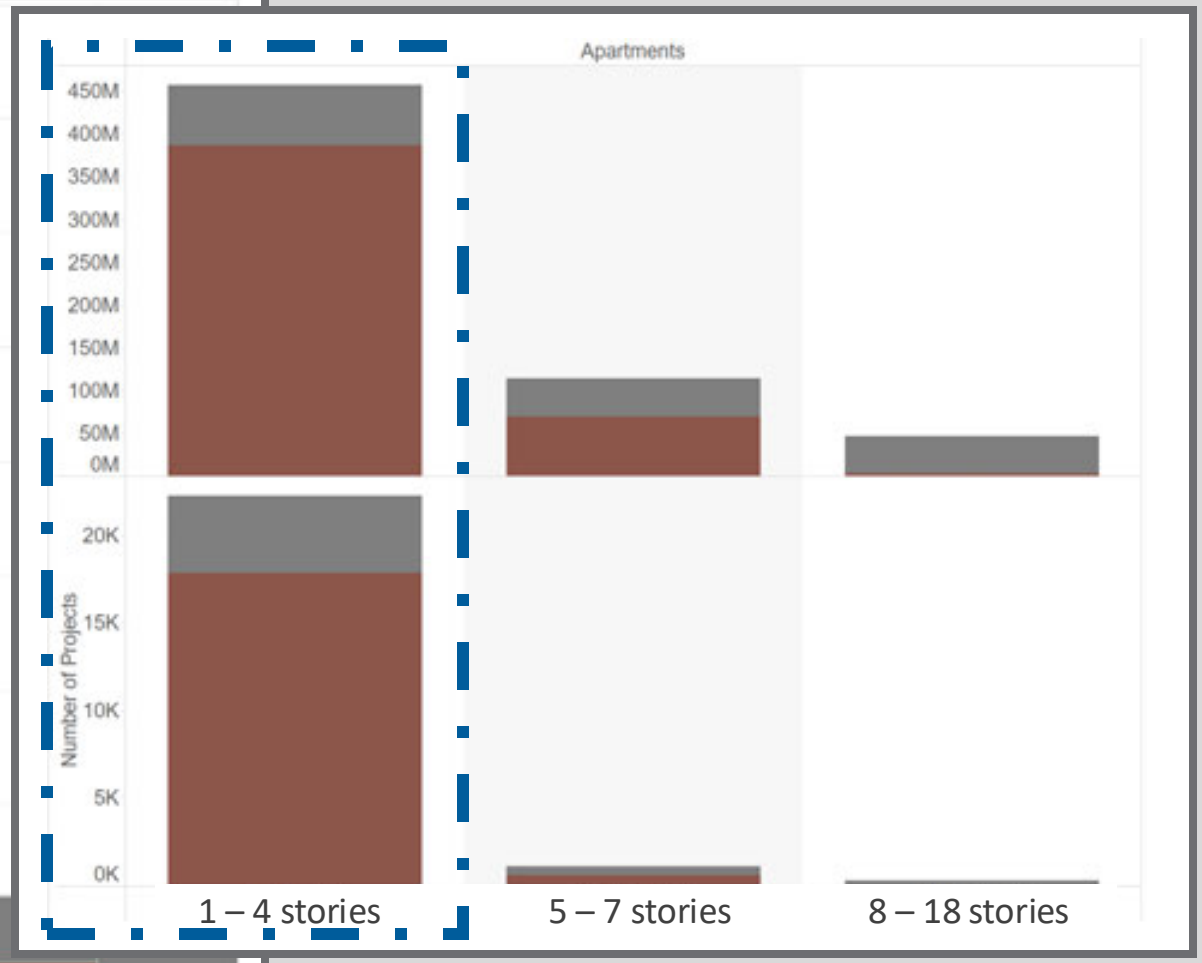
Source: 2024 Dodge Market Data

Market Data Analysis

Apartments: Average Building Size



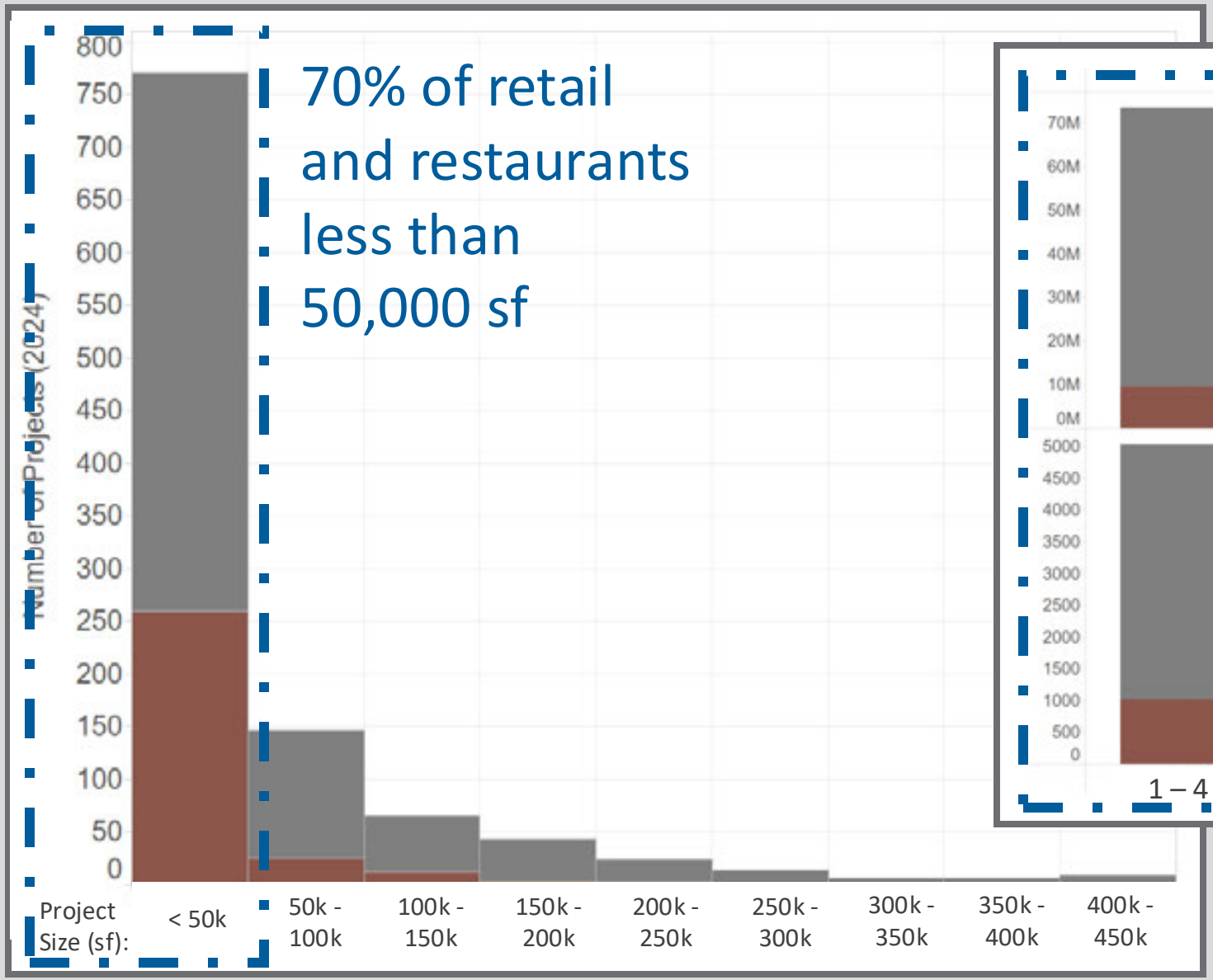
51% of apartments less than 150,000 sf

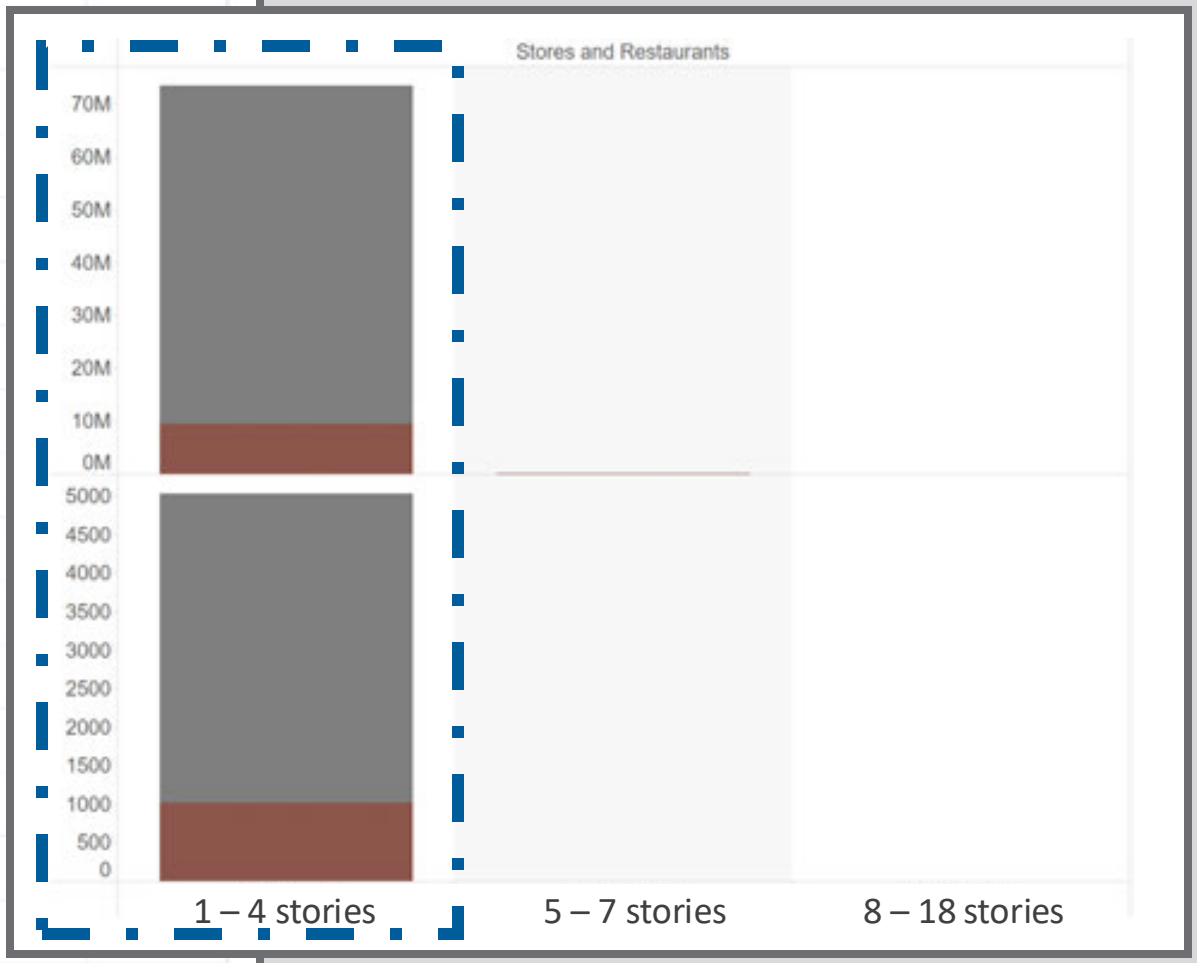


Source: 2024 Dodge Market Data

Market Data Analysis

Retail and Restaurants: Average Building Size

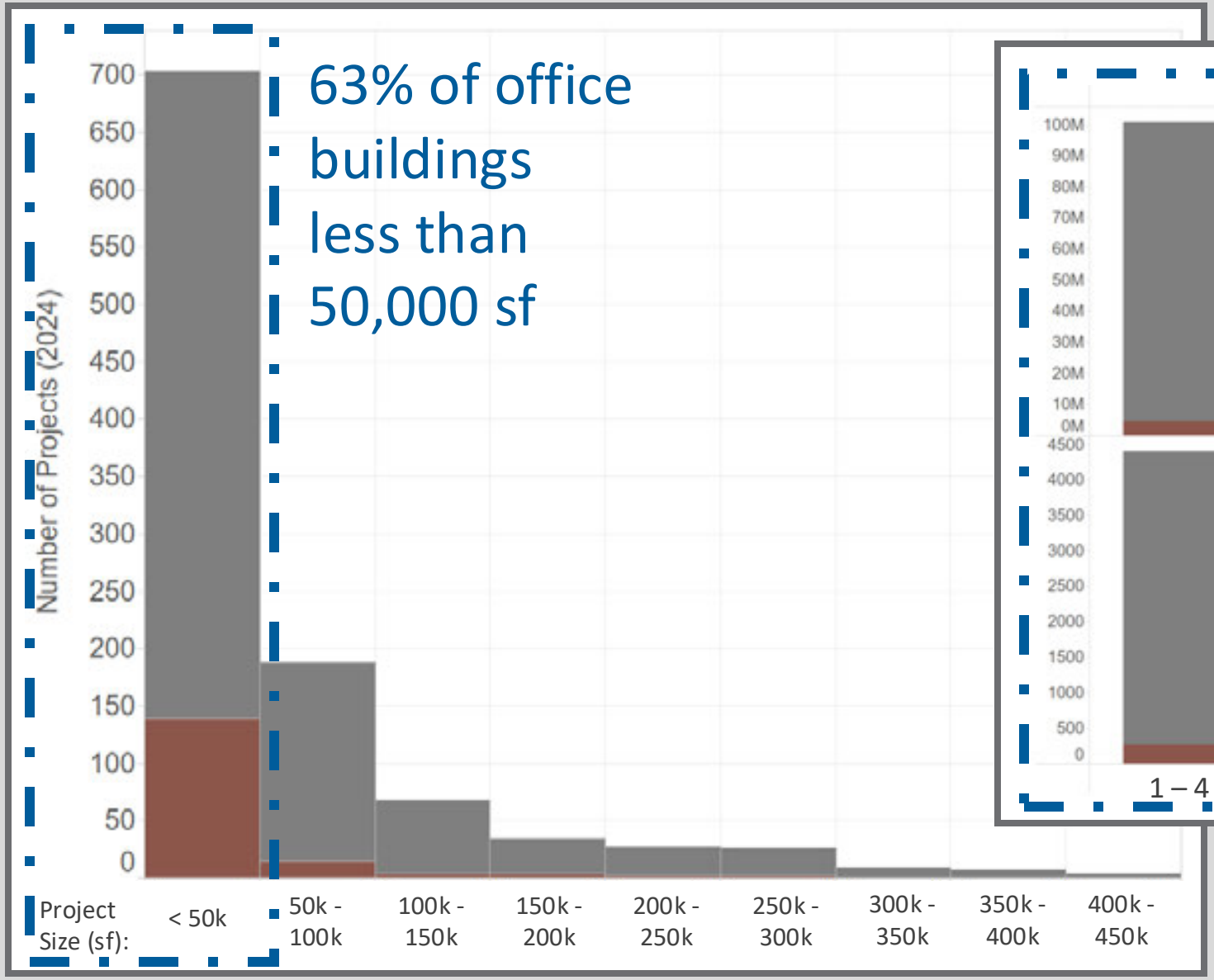


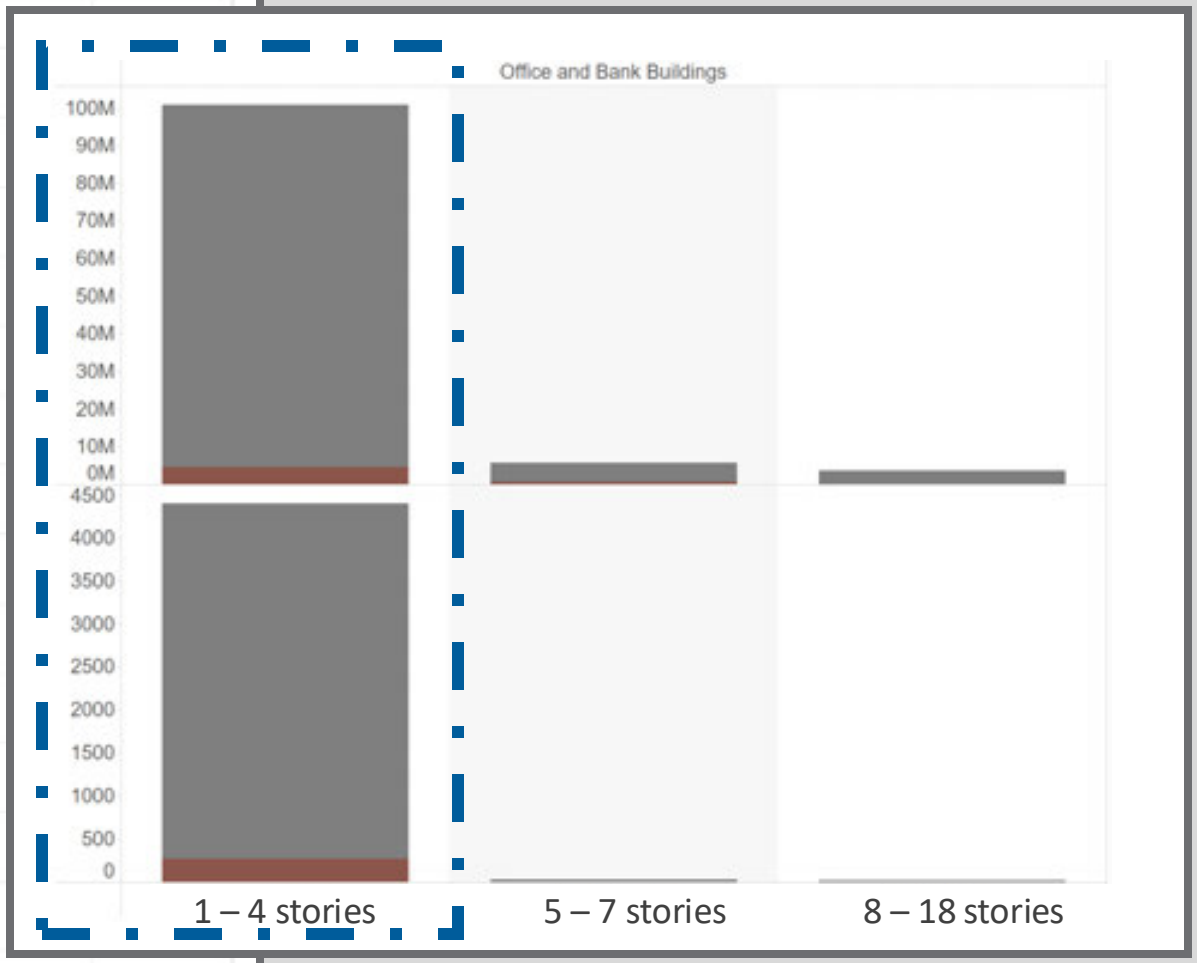


Source: 2024 Dodge Market Data

Market Data Analysis

Office Buildings: Average Building Size





Source: 2024 Dodge Market Data

Market Data Analysis

What does all this mean?

- Wood is **underutilized** in many commercial occupancy buildings.

	2024 Areas	% Wood Of Those Areas
Hotels	87% <150k sf	51% are wood
Apartments	51% <150k sf	40% are wood
Retail/Restaurant	70% <50k sf	34% are wood
Offices	63% <50k sf	20% are wood

- These can be framed with wood!

Why is that important?

Source: 2024 Dodge Market Data

iStock.com/Andranik Hakobyan

Allowable Building Size

Allowable building size based on:

- Fire department access
- Building occupancy / use
- Construction type

45 Asheland – Nasheville NC / Alberice Architecture + Design / Photo Greg Folkins

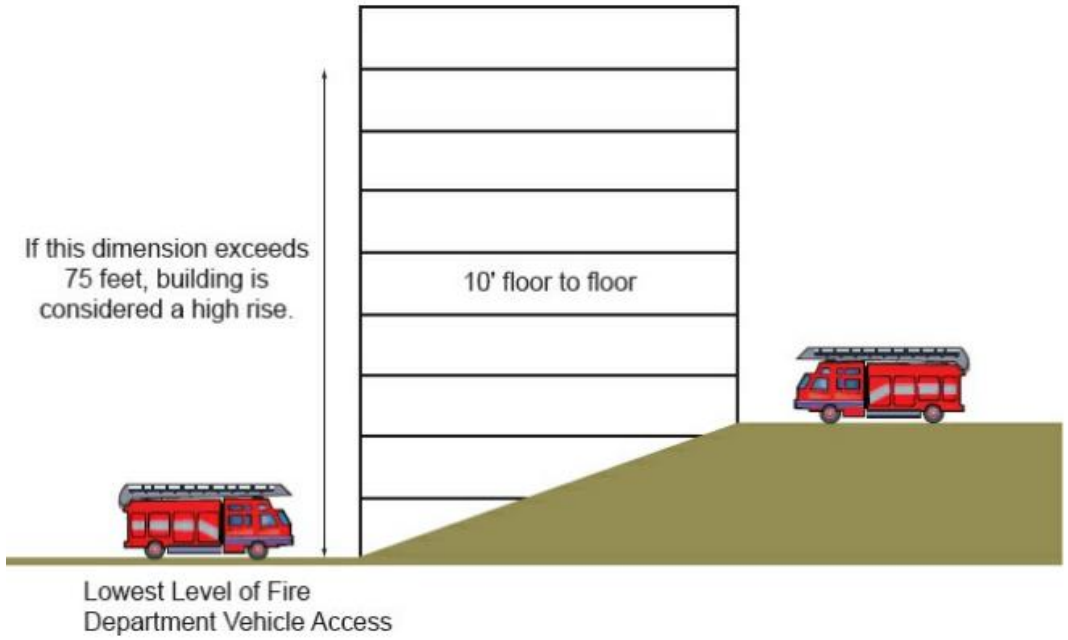
Allowable Building Size

Fire Department Access

- Mid-Rise vs. High-Rise

High-Rise Building:

(IBC 202) A building with an occupied floor located more than 75 feet above the lowest level of fire department vehicle access.

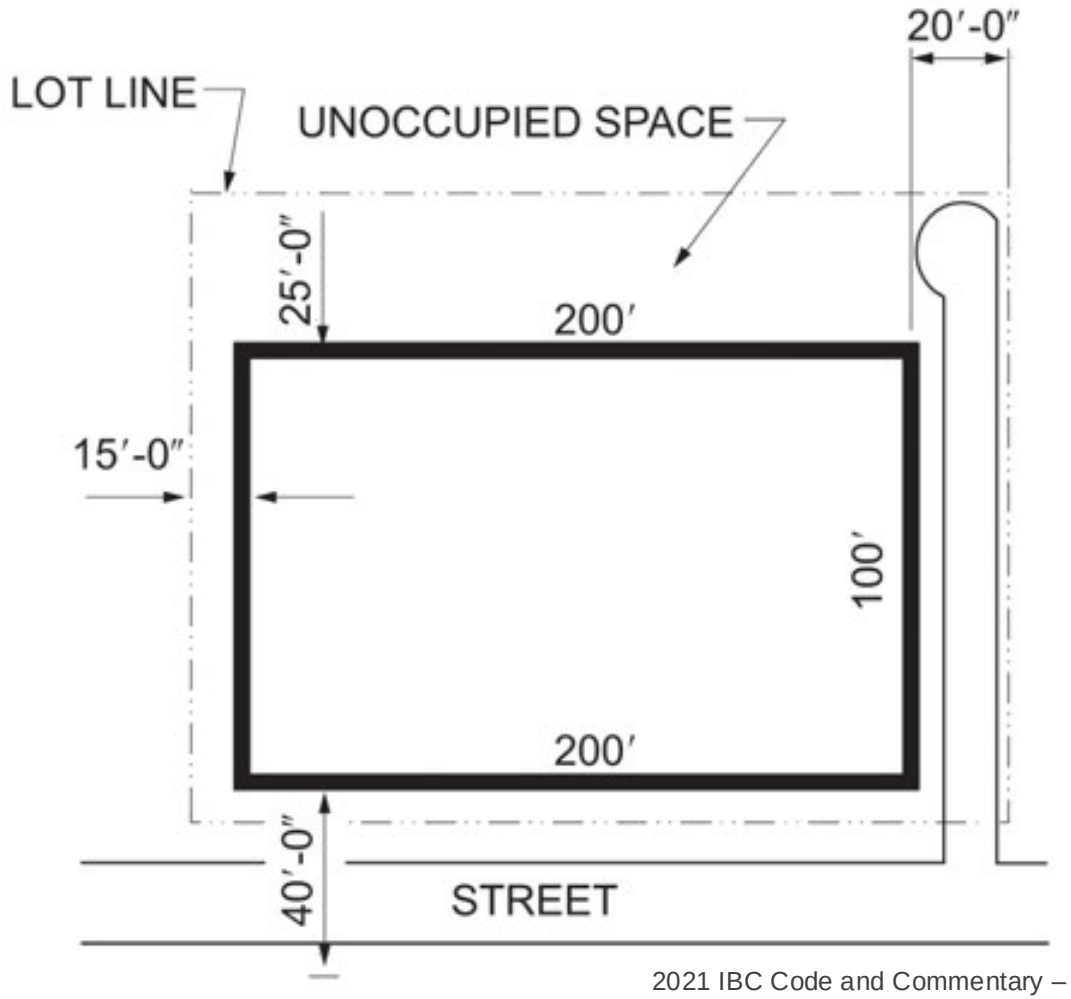


Building Code Essentials: Based on the 2021 International Building Code, Steve Thomas, CBO, Figure 6-7

Allowable Building Size

Fire Department Access

- Frontage (IBC 506.3)
  - Access to structure
  - Temporary refuge area
  - Reduced exposure to / from adjacent buildings



2021 IBC Code and Commentary – Volume 1, Commentary Figure 506.3.2

Allowable Building Size

Occupancy Groups

- Mixed-use buildings
  - 2, 3, or more occupancies
- Common mixed-use occupancies
  - **A:** *Assembly*: restaurant, theater, arena, lecture hall
  - **B:** *Business*: office, college, bank
  - **M:** *Mercantile*: retail, sales room
  - **R:** *Residential*: apartment, dormitory, hotel
  - **S:** *Storage*: parking, bulk storage

The Fowler / Holst Architecture / Axiom Engineers / Photo Gabe Border

Allowable Building Size

Construction Types

Type III

- Exterior walls non-combustible (may be FRTW)
- Interior elements any allowed by code

Type V

- All building elements are any allowed by code

Types III and V can be subdivided:

» A (protected)
» B (unprotected)

Type IV

- All building elements mass timber or non-combustible
- Some light frame allowances for Type IV-HT
- Minimum member sizes

Construction Type Differences

	TYPE IV				TYPE III		TYPE V	
	A	B	C	HT	A	B	A	B
Exterior Wall Material	CLT (protected)			FRTW (LF, MT), CLT (protected)	FRTW		Any wood	
Exterior Bearing Wall Rating	3-hr	2-hr		2-hr	2-hr		1-hr	0-hr
Interior Elements	Heavy Timber			Heavy Timber or LF for ≤ 1-hr FRR	Any wood		Any wood	
Fire Wall Materials	Non-combustible				Non-combustible		Any	
Building Size	Typically largest to smallest →							
	Large areas and heights for new tall mass timber types			Often same heights with larger areas for Type IV-HT	Comparable heights and areas		Smallest heights / areas	

Allowable Building Size

Allowable Building **Height** (IBC 2021 Tables 504.3 & 504.4)

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	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60

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	A	B	C	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	3	3	3	2	1
	S	UL	6	4	3	4	3	9	6	4	4	3	2
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	18	12	9	6	4	3
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2

2021 International Building Code

Allowable Building Size

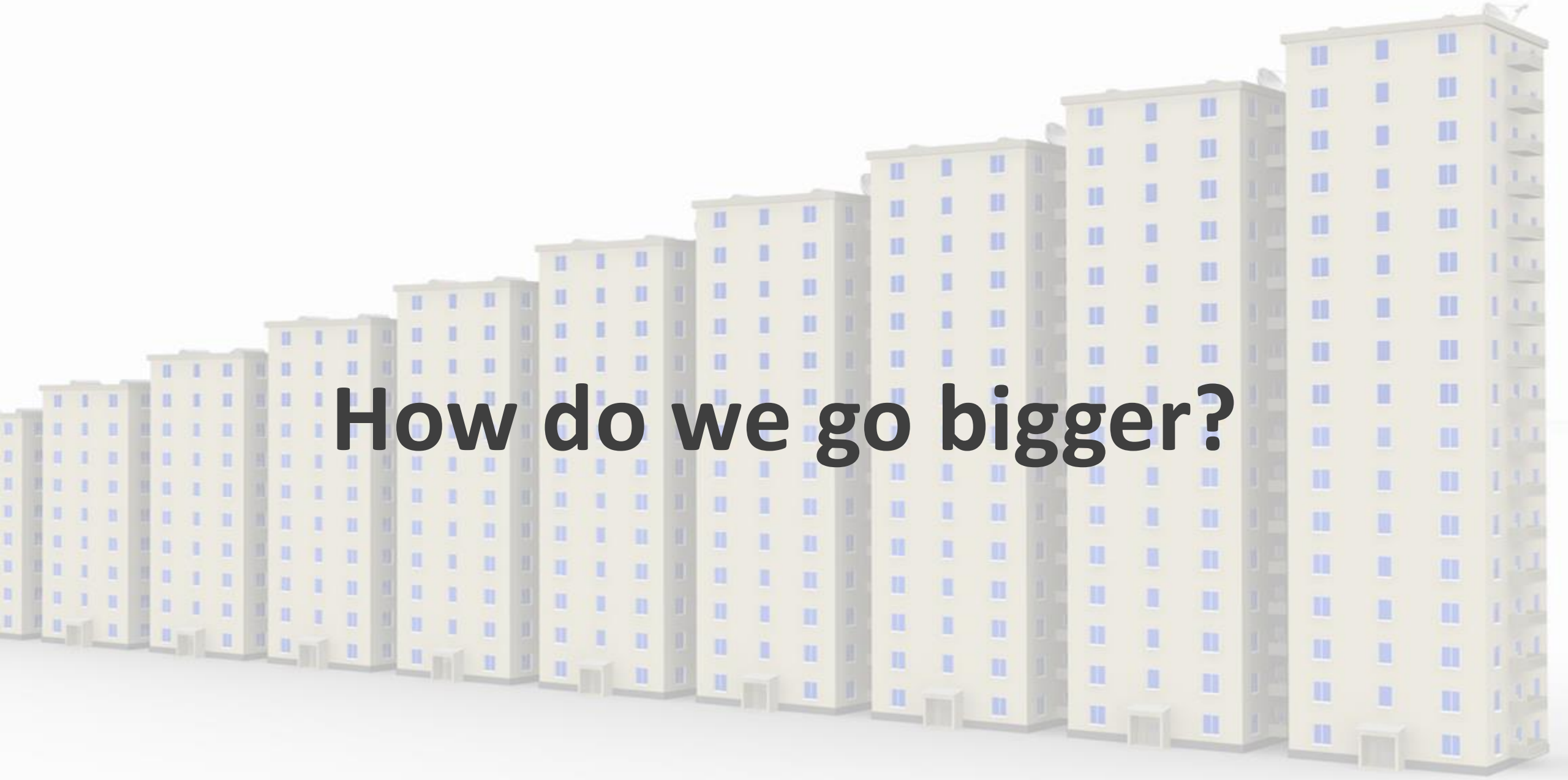
Allowable Story **Area** (IBC 2021 Table 506.2)

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	A	B	C	HT	A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,875	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	229,500	153,000	95,625	76,500	55,500	28,500

2021 International Building Code

How do we go bigger?



iStock.com/Waldemarus

Allowable Building Size

Allowable size increases:

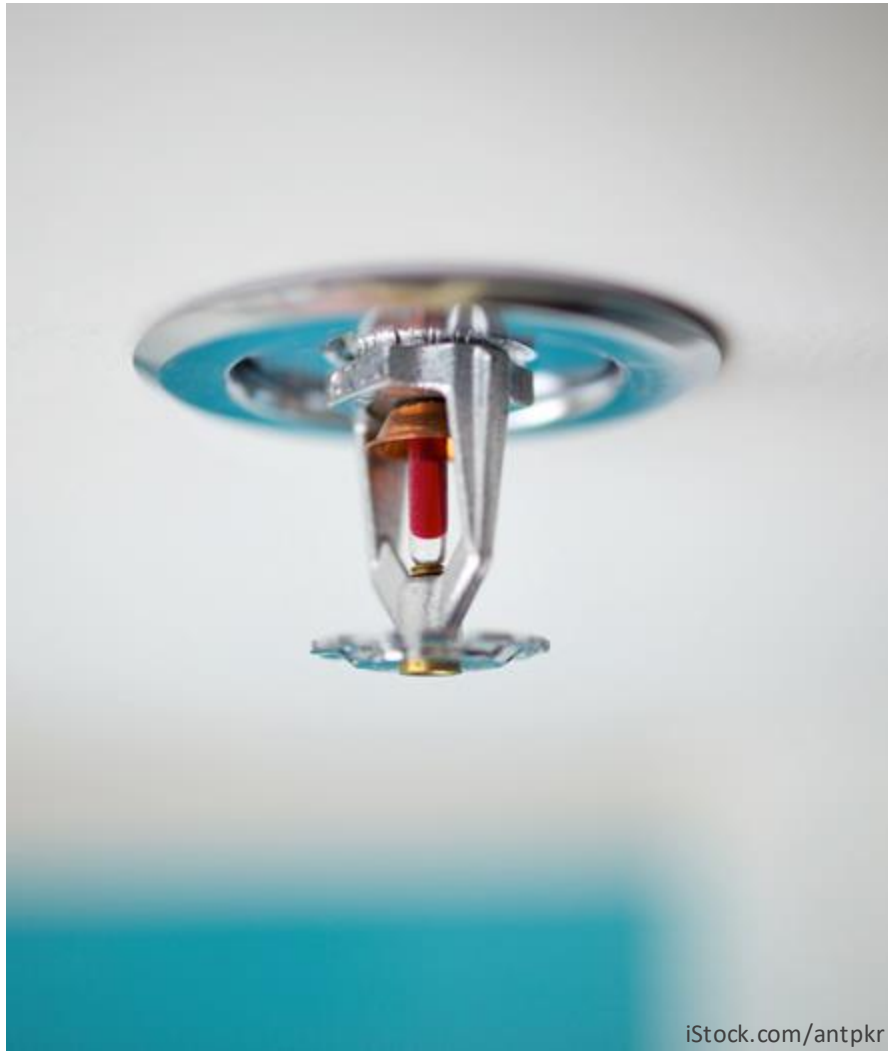
- Height / Number of stories
- Area per floor

Oleander Fort Worth / Lang Partners / JHP Architects / Gregory Folkins

Allowable Building Size

Building size increases

- Sprinkler Systems
  - IBC Chapter 9
  - NFPA 13 or NFPA 13R sprinkler systems
    - Required in all new R occupancies
    - NFPA 13 required in most commercial facilities (any sizes, construction types, materials)



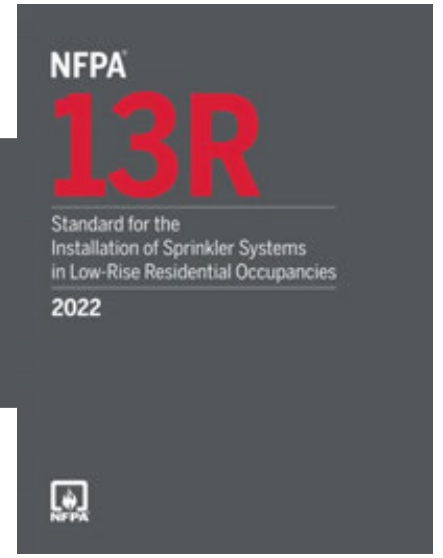
Allowable Building Size

Sprinkler Systems

- NFPA 13 (IBC 903.3.1.1)
  - Commercial construction
- NFPA 13R (IBC 903.3.1.2)
  - Residential occupancies (1- and 2-family, low-rise multi-family, commercial)
- NFPA 13D (IBC 903.3.1.3)
  - 1- and 2-family residences (and some commercial occupancies)


Adohi Hall, University of Arkansas / photo Timothy Hursley


Heritage Commons / James Zanetto / Buehler Engineering / Christian Cortes



Allowable Building Size

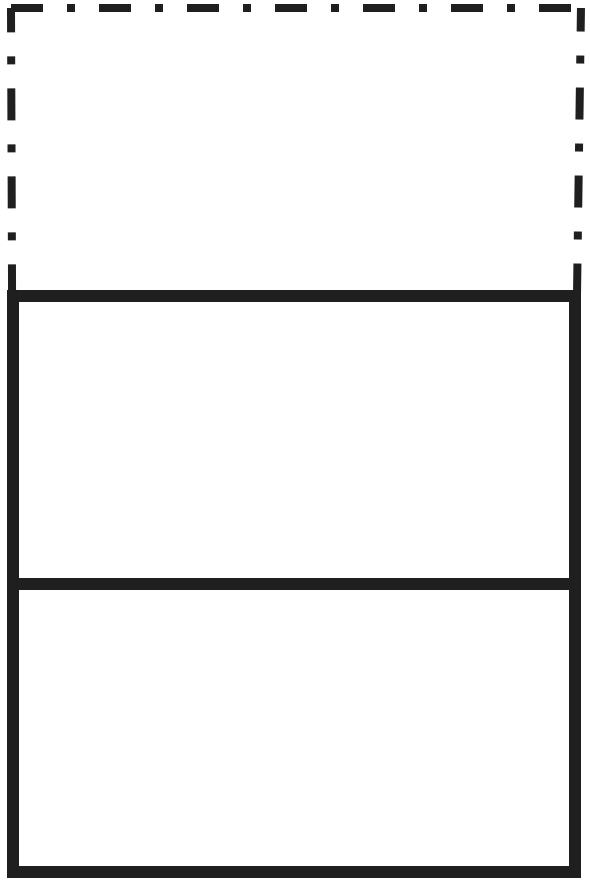
Sprinkler Systems

NFPA 13	NFPA 13R
Goal: Life safety and property protection	Goal: Provide life safety and limited property protection (to a lesser degree than NFPA 13)
Fully sprinklered system throughout entire building (including unoccupied spaces)	Partially sprinklered system; unoccupied spaces often not sprinklered
Can cost more	Lower water discharge levels, shorter water supply time; can result in smaller pipes, reduced storage and pumps
Acceptable many occupancies, building sizes; allows greater building size increases	Limited applications, mainly multi-family up to 4 stories, 60 feet

Allowable Building Size

Height increase

- NFPA 13 or 13R* sprinklered buildings
  - 1 story increase (IBC 2021 Table 504.3)
  - 10- to 20-foot increase (IBC 2021 Table 504.4)



* NFPA 13R limited to 4 stories and 30 feet from lowest level of fire department vehicle access

Allowable Building Size

Height Increase: Allowable Building **Height** (IBC 2021 Table 504.3)

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	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S13R	60	60	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	270	180	85	85	70	60

- **NS**: No sprinkler system
- **S**: NFPA 13 sprinkler system
- **S13R**: NFPA 13R sprinkler system
- **S13D** *(not shown)*: NFPA 13D sprinkler

Allowable Building Size

Height Increase: Allowable Building **Height** (IBC 2021 Table 504.4)

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

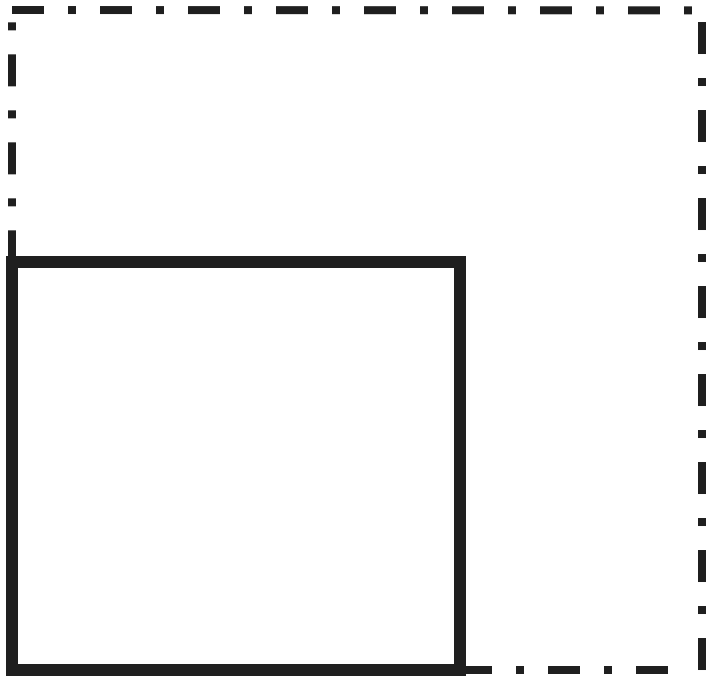
OCCUPANCY CLASSIFICATION	See Footnotes	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	18	12	9	6	4	3
R-1[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	18	12	8	5	4	3
R-2[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4	4								4	3
	S	UL	12	5	5	5	5	18	12	8	5	4	3

- **NS**: No sprinkler system
- **S**: NFPA 13 sprinkler system
- **S13R**: NFPA 13R sprinkler system
- **S13D** *(not shown)*: NFPA 13D sprinkler

Allowable Building Size

Area increase

- NFPA 13 or sprinklered buildings
  - Single story buildings: 300% increase
  - Multi-story buildings: 200% increase



Allowable Building Size

Area Increase: Allowable Story **Area** (IBC 2021 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	A	B	C	HT	A	B
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000
R-1[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000

- **NS**: No sprinkler system

*Note: Area increases for frontage may still be applicable (IBC 506.3)

- **S1**: 1-story with NFPA 13 sprinkler
- **SM**: 2+ stories with NFPA 13 sprinkler
- **S13R:** NFPA 13R sprinkler
- **S13D** *(not shown)*: NFPA 13D sprinkler

Allowable Building Size

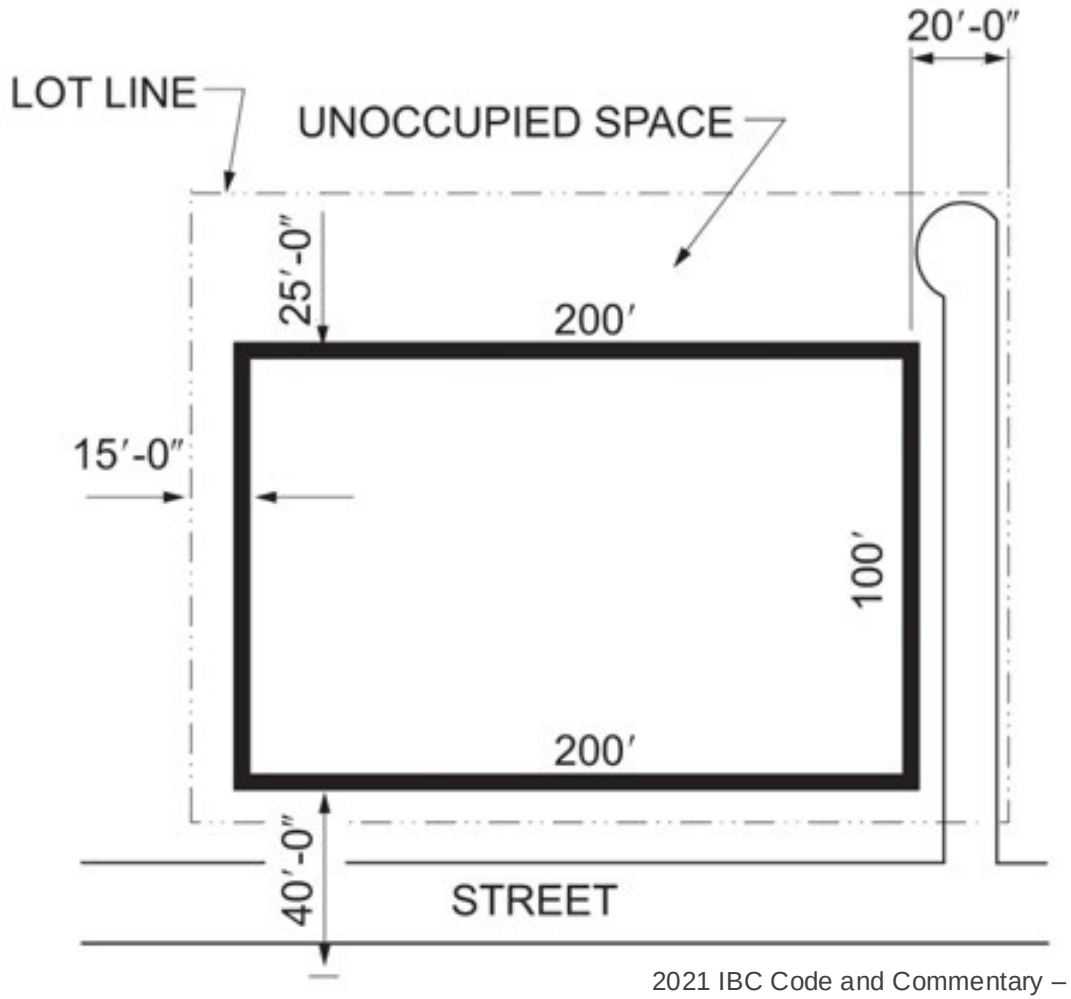
Building size increases

- Frontage
  - IBC 506.3
  - Clear spaces around building perimeter
    - Minimum 25% open frontage required (20-foot distance from building)

Allowable Building Size

Fire Department Access

- Frontage (IBC 506.3)
  - Access to structure
  - Temporary refuge area
  - Reduced exposure to / from adjacent buildings



2021 IBC Code and Commentary – Volume 1, Commentary Figure 506.3.2

Allowable Building Size

Frontage area increase

- Frontage increase factor, I_f
  - Max I_f is 0.75
- Increased area = $A_t + (NS * I_f)$
  - A_t = Tabulated area (Table 506.2)
  - NS = Tabulated non-sprinklered building area (Table 506.2)

Woodfield Gateway – Durham NC / The Housing Studio / McVeigh & Mangum Engineering / photo Greg Folkins

Frontage Increases – 2021/2024 IBC 506.3.3

I_f = Area factor increase due to frontage

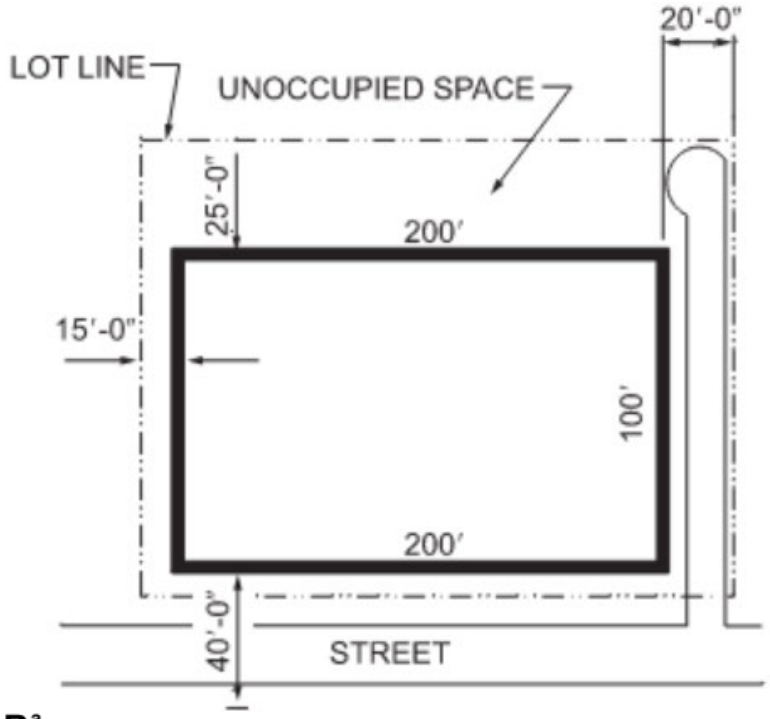


TABLE 506.3.3
FRONTAGE INCREASE FACTOR[a]

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)			
	0 to less than 20	20 to less than 25	25 to less than 30	30 or greater
0 to less than 25	0	0	0	0
25 to less than 50	0	0.17	0.21	0.25
50 to less than 75	0	0.33	0.42	0.50
75 to 100	0	0.50	0.63	0.75

Total Building Area – IBC 506.2

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

(Equation 5-2)

A_a = Allowable area, total (sq. ft.)

A_t = Tabular allowable area per story per Table 506.2 for NS, S1 or S13R (sq. ft.)

NS = Tabular allowable area per story per Table 506.2 for non-sprinklered building (sprinklered or not)

I_f = Area increase factor due to frontage per 506.3
I_f, max = 0.75

S_a = Actual number of building stories above grade

$S_{a,\,max}$ = 3 for non-sprinklered buildings and those w/ NFPA13

$S_{a,\,max}$ = 4 for buildings w/ NFPA 13R

Allowable Building Size

Business (B) occupancies with NFPA 13 sprinklers

B Occupancy with NFPA 13	**IV-A**	**IV-B**	**IV-C**	**IV-HT**	**III-A**	**III-B**	**V-A**	**V-B**
Max stories	18	12	9	6	6	4	4	3
Max height (ft)	270	180	85	85	85	75	70	60
Max story area (ft^2)	405.0k	270.0k	168.8k	135.0k	106.9k	71.3k	67.5k	33.8k
2-story: Max total area (ft^2)	810.0k	540.0k	337.5k	270.0k	213.8k	142.5k	135.0k	67.5k
3+ story: Max total area (ft^2)	1,215.0k	810.0k	506.3k	405.0k	320.6k	213.8k	202.5k	101.3k

* Note: areas assumes maximum frontage increase

Allowable Building Size

Residential (R-2) occupancies with NFPA 13 sprinklers

R-2 Occupancy with NFPA 13	**IV-A**	**IV-B**	**IV-C**	**IV-HT**	**III-A**	**III-B**	**V-A**	**V-B**
Max stories	18	12	8	5	5	5	4	3
Max height (ft)	270	180	85	85	85	75	70	60
Max story area (ft^2)	230.6k	153.8k	96,844	76.9k	90.0k	60.0k	45.0k	26.3k
2-story: Max total area (ft^2)	461.3k	307.5k	192.2k	153.8k	180.0k	120.0k	90.0k	52.5k
3+ story: Max total area (ft^2)	691.9k	461.3k	288.3k	230.6k	270.0k	180.0k	135.0k	78.8k

* Note: areas assumes maximum frontage increase

Allowable Building Size

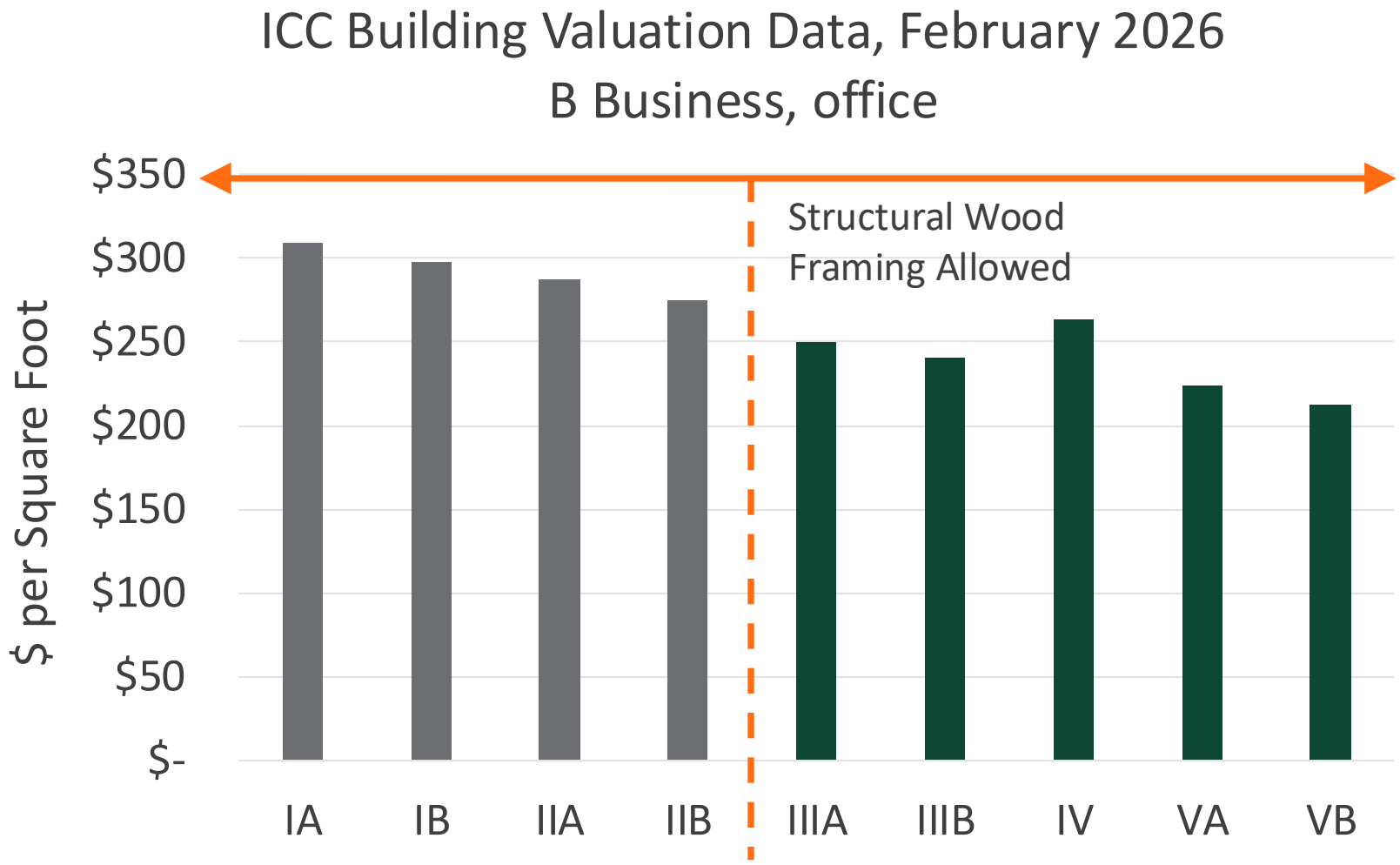
Why is construction type so important?

- Low- to mid-rise buildings
  - Often default to Type II construction
  - Nearly identical building sizes for Type III
  - Many commercial / multi-family projects can be Type V

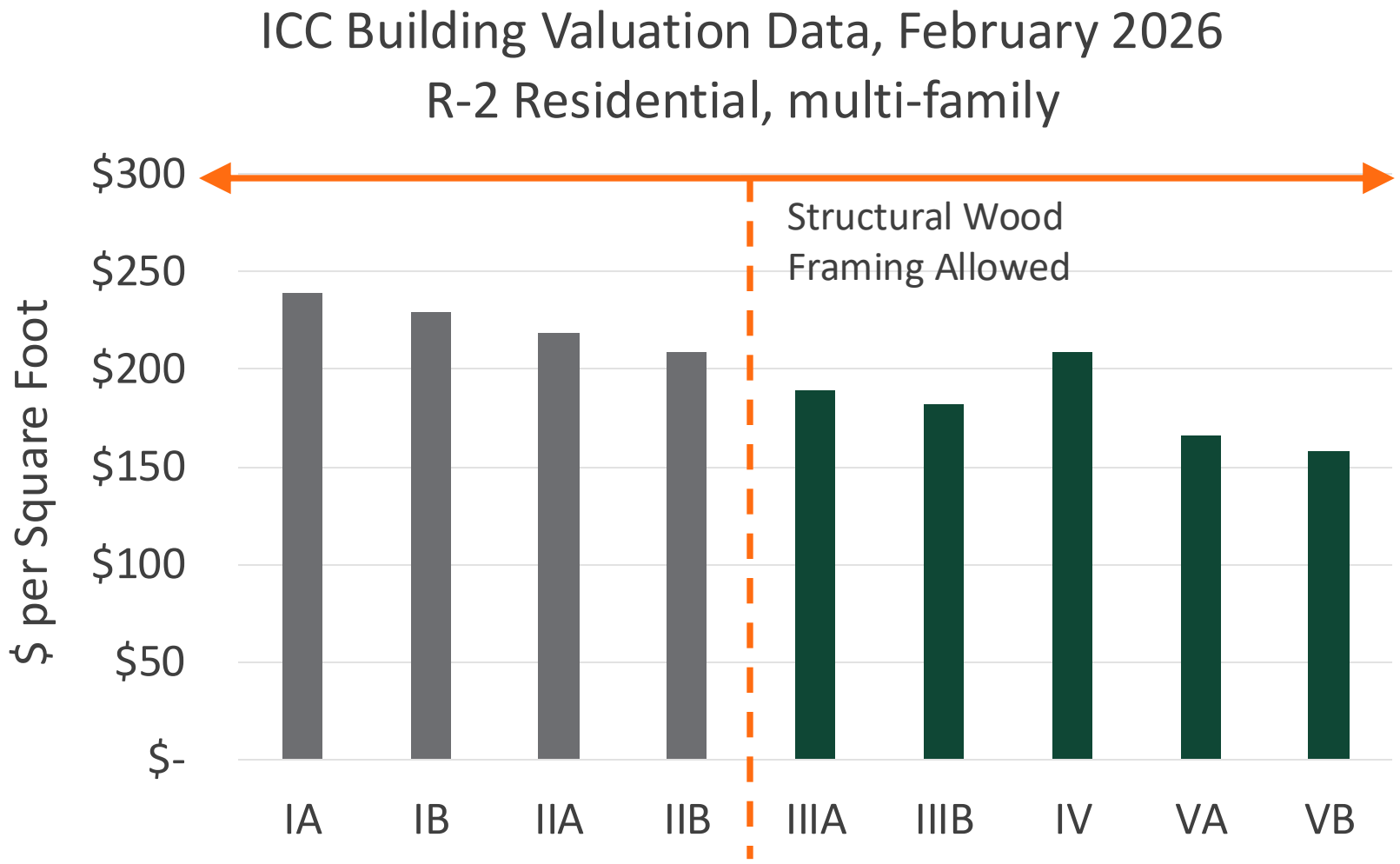
Wood framing can be used for Types III and V!

iStock.com/Andranik Hakobyan

ICC Building Valuation Data



ICC Building Valuation Data

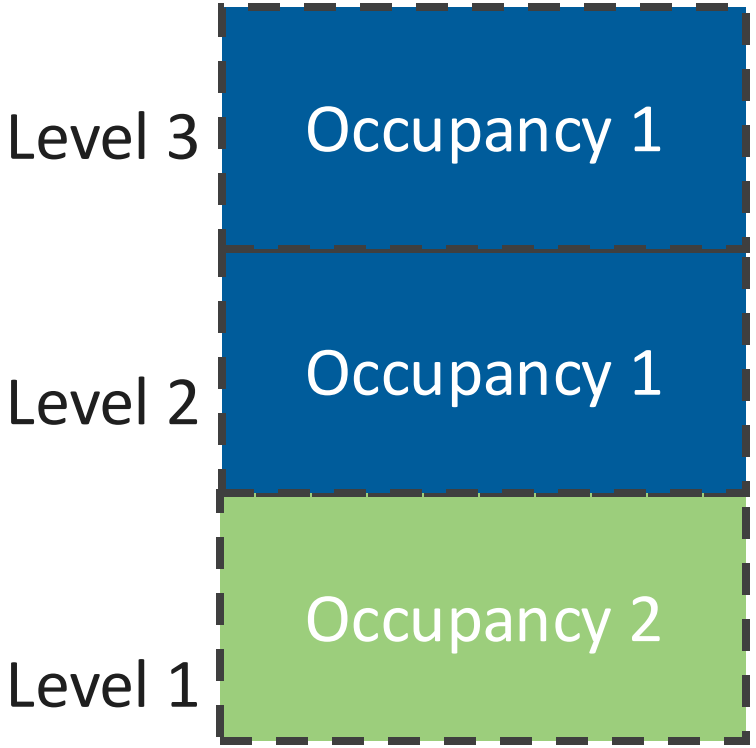


Mixed Use Buildings: Mixing Occupancies

North Commons Residences / Grugnale Properties / Annino Incorporated / Gregory Folkins

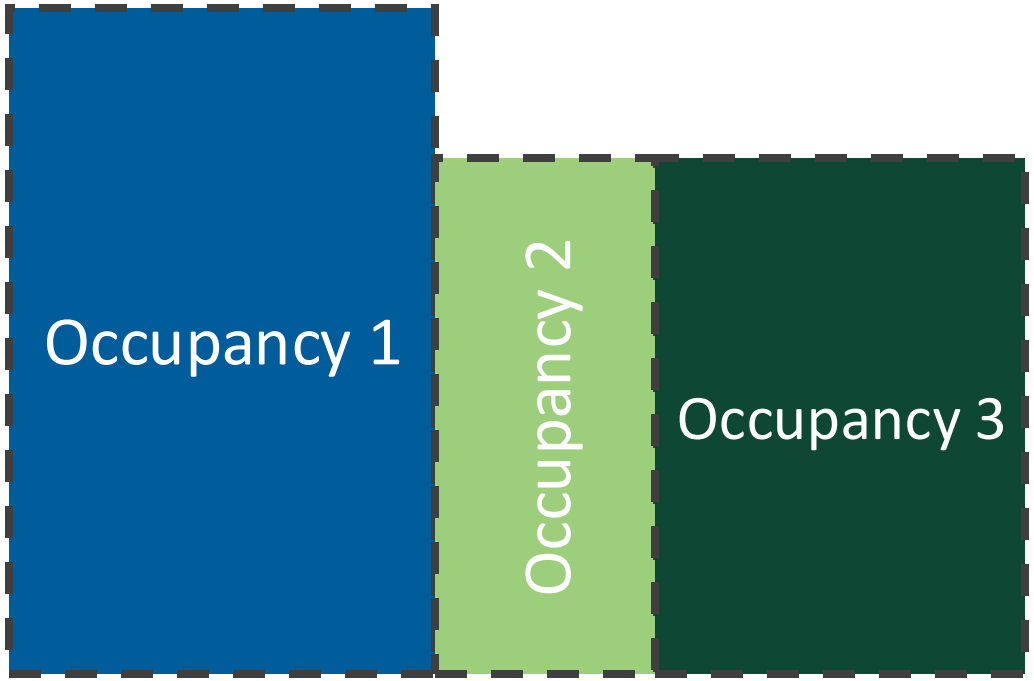
Mixed Occupancy Buildings

» Different occupancies on **different** levels:



Elevation view

» Different occupancies on **same** level:



Plan View

Building Configuration:

Start with the **lowest common denominator** option, then work up

Don’t assume construction type, separation requirements, etc. based on materials, occupancy, etc.

District Flats – Charlotte NC / Studio Fusion / Larry Harwell

Mixed Occupancy Buildings

Lowest common denominator

- Unseparated occupancies
  - Special provisions
  - Other design allowances
- Work up from there *if needed*

Water Marq / CWS / Kelly Grossman Architects / Gregory Folkins

Mixed Occupancy Buildings

Example: 3-story urban infill project

iStock.com/studiogstock

- NPFA 13 sprinkler system throughout
- Enclosed parking garage
- Grade to mean roof height: 38 ft

- Basement: 12,000 sf parking
- 1st floor: Parking, 9,500 sf
  Insurance agency, 1,200 sf
  Print shop, 1,300 sf
- 2nd floor: Martial arts studio, 2,400 sf
  Apartments, 9,600 sf
- 3rd floor: Apartments, 12,000 sf

Mixed Occupancy Buildings

Example: 3-story urban infill project

	Parking (S-2)	Insurance Agency (B)	Print Shop (B)	Martial Arts Studio (B)	Apartments (R-2)
3rd floor	-	-	-	-	12,000 sf
2nd floor	-	-	-	2,400 sf	9,600 sf
1st floor	9,500 sf	1,200 sf	1,300 sf	-	-
Basement	12,000 sf	-	-	-	-

Note: Basements not to be included in maximum area / story checks (IBC 504, 506)

Mixed Occupancy Buildings

Example: 3-story urban infill project

» Lowest common denominator: **Type V-B** construction

Type V-B Construction	**S-2**	**B**	**R-2**	**Actual Building**
Max # stories	3	3	3	3
Max height	60 ft	60 ft	60 ft	38 ft
Max floor area	40,500 sf	27,000 sf	21,000 sf	12,000 sf
Max total area	121,500 sf	81,000 sf	63,000 sf	36,000 sf

Most restrictive occupancy →

→ Type V-B construction with non-separated occupancies OK

Mixed Occupancy Buildings

Example: 3-story urban infill project

iStock.com/studiogstock

Type V-B 3-story mixed-use:

- Can be fully framed with wood
  - Note: Can still use other materials if desired
- No podium required
- No fire rated separation between occupancies (unless required by other provisions)

Mixed Occupancy Buildings: Special Provisions and Design Allowances

Broadstone Apartments on 5th – Fort Worth / Gregory Folkins

Mixed Occupancy Buildings

- Special provisions & design allowances:
  - Incidental Uses (509)
  - Accessory Occupancies (508.2)
  - Occupancy Combinations (303 & 302)
  - Roof Top Occupancies (503.1)
  - Special Provisions (510)
- Nonseparated Occupancies (508.3)
- Separated Occupancies (508.4)
- Separate Buildings – Firewalls (503.1 & 706)
- Other….

North Commons Residences / Grugnale Properties / Annino Incorporated / Gregory Folkins

Mixed Occupancy Buildings: Incidental Uses

Incidental Uses (IBC 509)

- Ancillary function associated with occupancy
- Poses **greater** risk than main occupancy
- Examples:
  - Laundry room over 100 sf
  - Refrigerant machinery room
  - Incinerator room
  - Furnace room
  - Boiler room
  - Vocational shop in a school

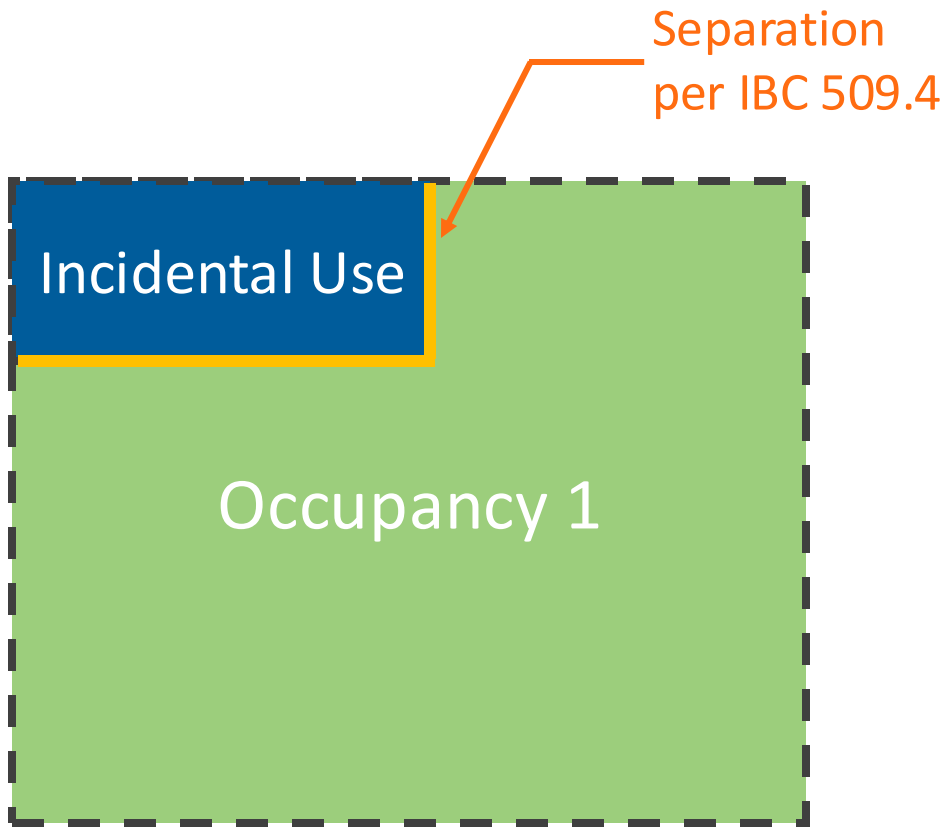
Mixed Occupancy Buildings: Incidental Uses

Requirements:

- **Each** area not more than 10% of story
- Separation and protection per IBC 509.4 and Table 509
  - FRR separation (fire barriers, horizontal assemblies)
  - AND / OR Sprinkler system and smoke separation

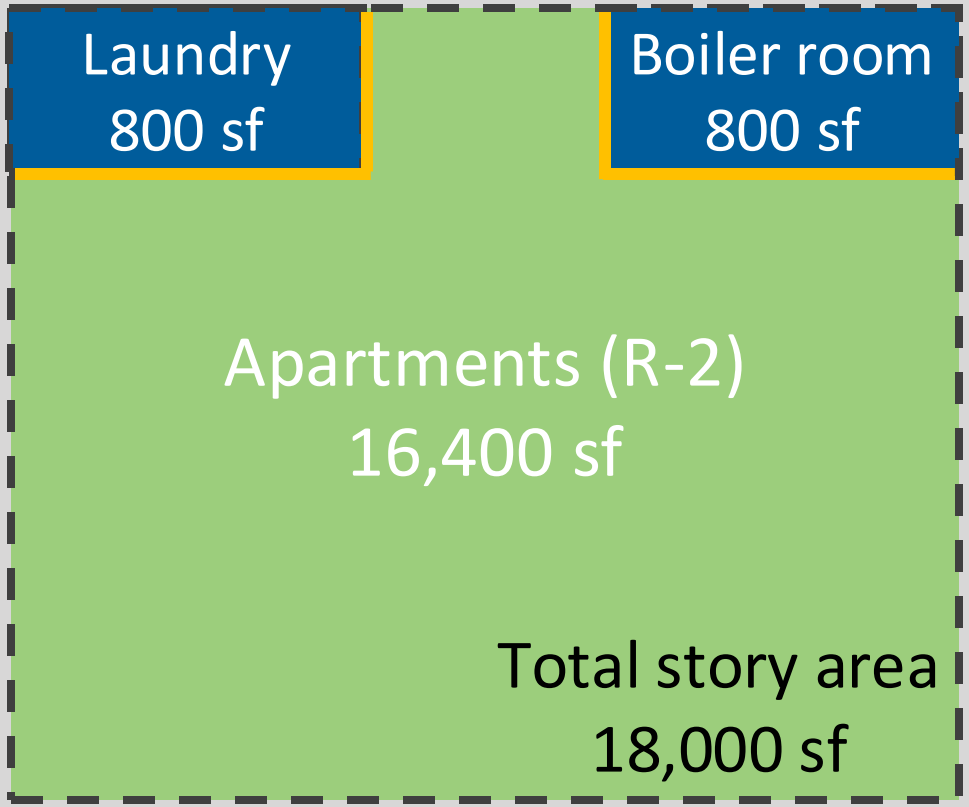
Benefits:

- Not classified as different occupancy
- Allowable area and height per main occupancy



Mixed Occupancy Buildings: Incidental Uses

Example: Incidental Uses



- 4-story building
- Type V-A
- NFPA 13 sprinklered

- Level 1: Apartments (R-2), 16,400 sf
  Laundry room, 800 sf
  Boiler room, 800 sf
- Levels 2, 3, 4: Apartments (R-2), 18,000 sf
- Total area 72,000 sf

Mixed Occupancy Buildings: Accessory Occupancies

Accessory Occupancies (IBC 508.2)

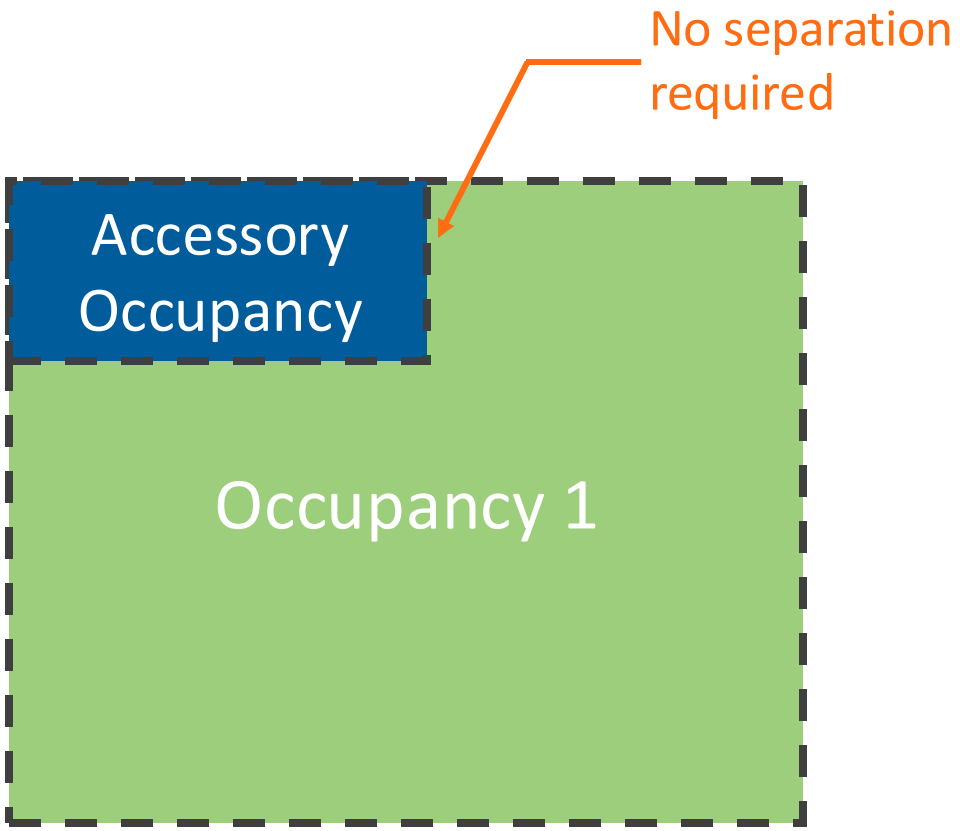
- Ancillary to the main occupancy

Requirements:

- **Aggregate** accessory area not greater than:
  - 10% of main occupancy on same floor
  - Table 506.2 non-sprinklered allowable area limits for accessory occupancy

Benefits:

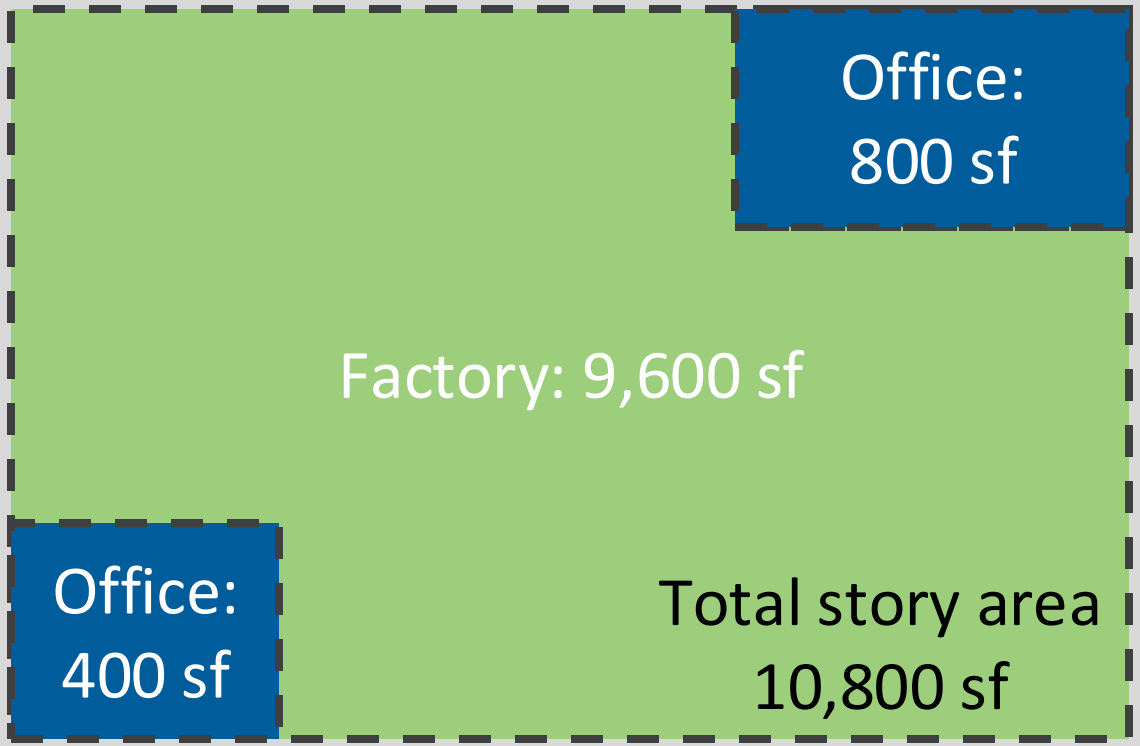
- No separation between occupancies*
- Allowable building area and height per main occupancy



* Separation required for hazardous occupancies and residential separations

Mixed Occupancy Buildings: Accessory Occupancies

Example: Accessory Occupancies

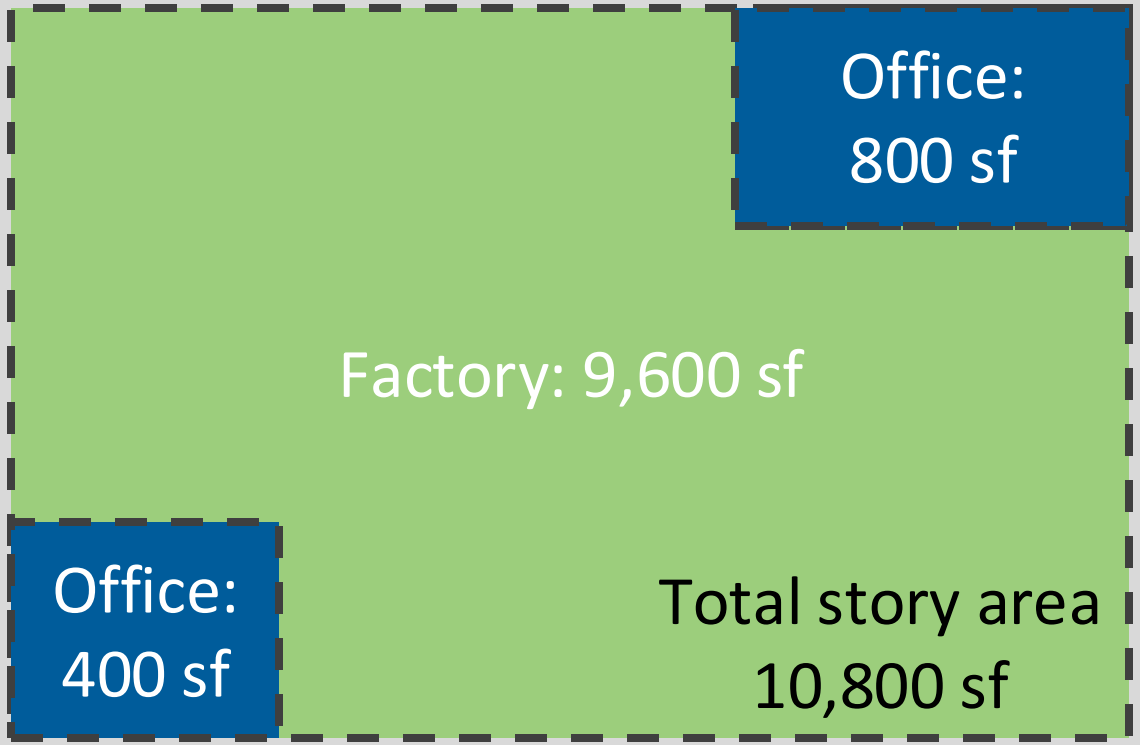


- 1-story building
- Type V-A
- No sprinklers

- Factory (F-1), 9,600 sf
- Two office areas (B), 400 sf & 800 sf (total office area of 1,200 sf)
- Total area 10,800 sf

Mixed Occupancy Buildings: Accessory Occupancies

Example: Accessory Occupancies



- Check main occupancy (F) areas (Table 506.2)
  - Max story area = 14,000 sf
  - Max building area = 14,000 sf
- Check allowable accessory areas:
  - 10% of story area = 10% x 10,800 sf = 1,080 sf
    → Not OK for accessory occupancy
- Potential solutions:
  - Reduce office area
  - Increase factory area
  - Mixed-use occupancies

Mixed Occupancy Buildings: Small Assembly Spaces

Small Assembly Spaces (IBC 303.1.1 & 303.1.2)

- Small buildings and tenant spaces (IBC 303.1.1)
  - Group B occupancy if:
    - For assembly purposes
    - Number of occupants < 50
- Small assembly spaces (IBC 303.1.2)
  - Group B occupancy if:
    - Number of occupants < 50
    - Area < 750 sf

Mixed Occupancy Buildings:
Assembly Spaces in Educational Facilities

Assembly Spaces in Educational Facilities (IBC 303.1.3)

- Space associated with Group E occupancy
- Room / space used for assembly purposes

Franklin Elementary School / MSES Architects / City Construction Company

Mixed Occupancy Buildings:
Educational Spaces in Places of Worship

Educational Spaces in Places of Worship (IBC 303.1.4)

- Accessory religious educational rooms and auditoriums
- Number of occupants < 100

Church of the Incarnation Chapel Parish Hall and Education Addition / HH Architects / Datum Engineering / Photo HH Architects

Mixed Occupancy Buildings: Multiple Functions

Buildings used for Multiple Functions (IBC 302.1)

- Room or space to be occupied at different times for different purposes
- Shall comply with **all** requirements of **each** purpose

Lake Stickney Elementary School / DLR Group / Chris J. Roberts Photography

Mixed Occupancy Buildings: Rooftop Decks

Rooftop Decks (IBC 503.1)

- Typically not included in height or number of stories checks
  - Not classified as a story per **story** definition (IBC 202)
  - Clarified in 2021 IBC 503.1.4
- Egress requirements (IBC 1006.3)
- Occupancy requirements
  - Verify occupancy permitted for story immediately below

Alvera / DJR Architects / Sandman Structural Engineers / Photo Korey Kevin Studio

Mixed Occupancy Buildings: Special Provisions

Permitted variation in heights/ areas checks for special conditions (IBC 510)

- Horizontal building separation
- Parking beneath Group R
- Group R-1 and R-2, Type III-A buildings height/story increase

The Fowler / Holst Architecture / Axiom Engineers / photo Gabe Border

Mixed Occupancy Buildings: Special Provisions

Horizontal Building Separation **(Podium Provision)** (IBC 510.2)

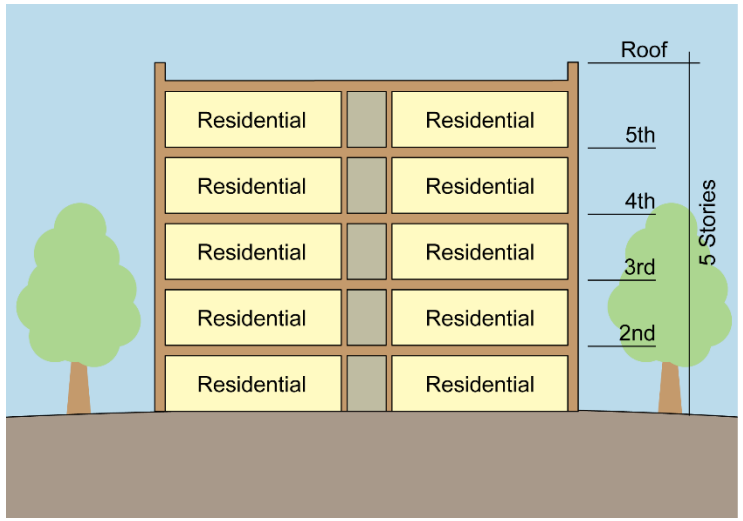
- Considered separate buildings above and below podium for stories and areas checks *if*:
  - Buildings separated by 3-hr FRR horizontal assembly **(podium)**
  - Building below is Type I-A and sprinklered
  - Max building height limited to minimum of either building

Broadstone Saratoga / Urbal Architecture / Axiom Engineering / Chad Case Photography

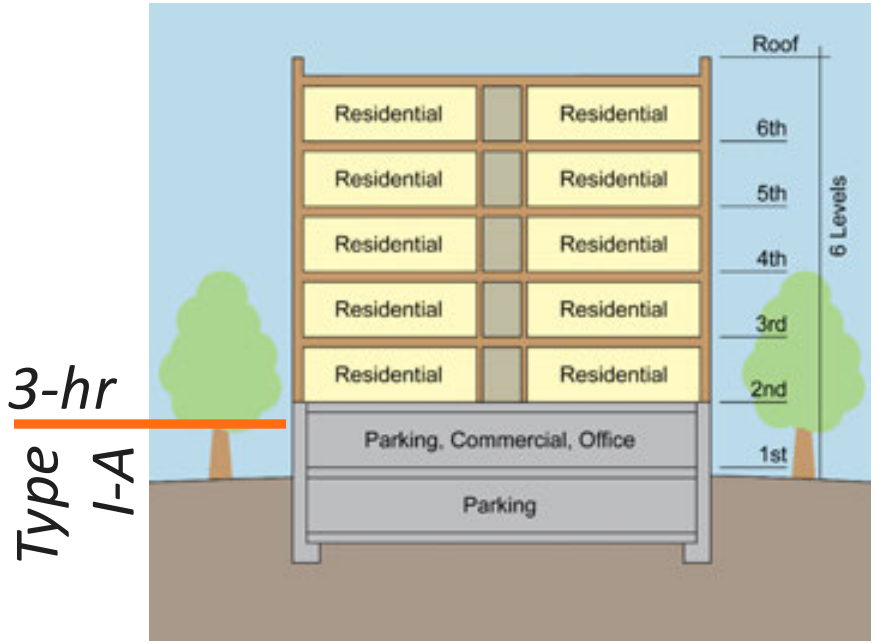
Mixed Occupancy Buildings: Special Provisions

Horizontal Building Separation **(Podium Provision)** (IBC 510.2)

5-story Type III building:



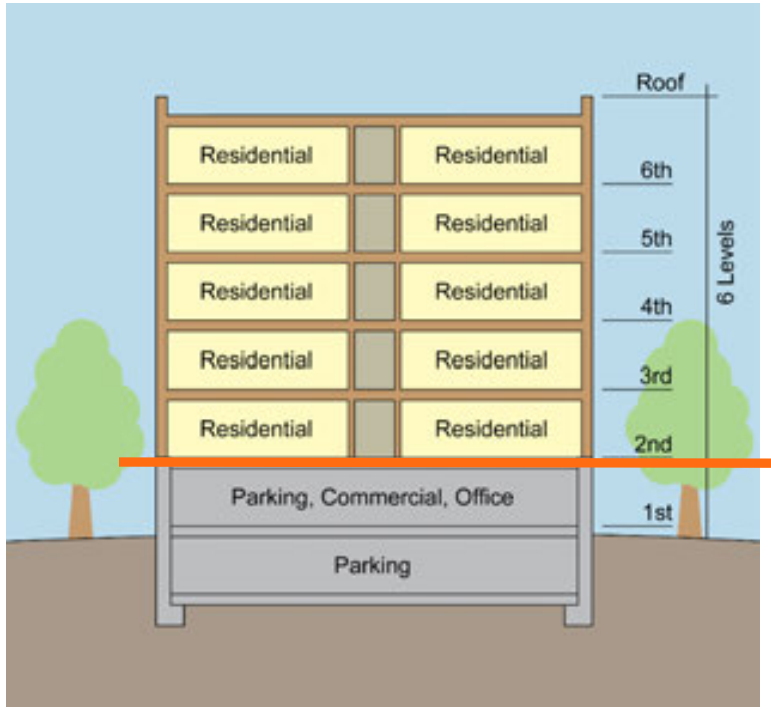
5-story Type III building over Type I-A podium:



Note: Increases allowable stories… not allowable building height

Mixed Occupancy Buildings: Special Provisions

Horizontal Building Separation **(Podium Provision)** (IBC 510.2)



3-hr

Type I-A

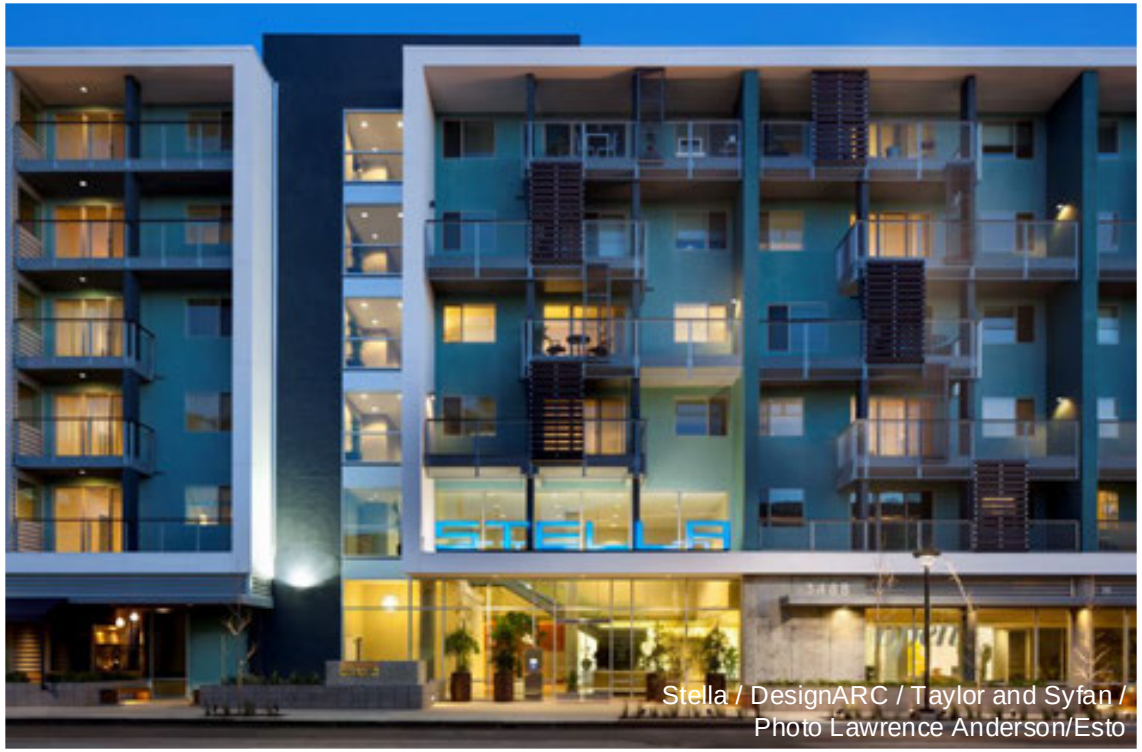
IBC	2006	2009	2012	2015	2018	2021
Section	509.2	509.2	510.2	510.2	510.2	510.2
Upper Occupancy	A, B, M, R or S					
Lower Occupancy	S-2 Parking	A, B, M, R or S-2 Parking		Any Except H		
Podium Height	1 Story			No Restriction		

Mixed Occupancy Buildings: Special Provisions

Horizontal Building Separation **(Podium Provision)** (IBC 510.2)

6 stories:

5-story Type III over 1-story podium:



Stella / DesignARC / Taylor and Syfan /
Photo Lawrence Anderson/Esto

7 stories:

5-story Type III over 2-story podium:

Marselle Condominiums / PB Architects /
Yu & Trochalakis / Matt Todd Photography

Mixed Occupancy Buildings: Special Provisions

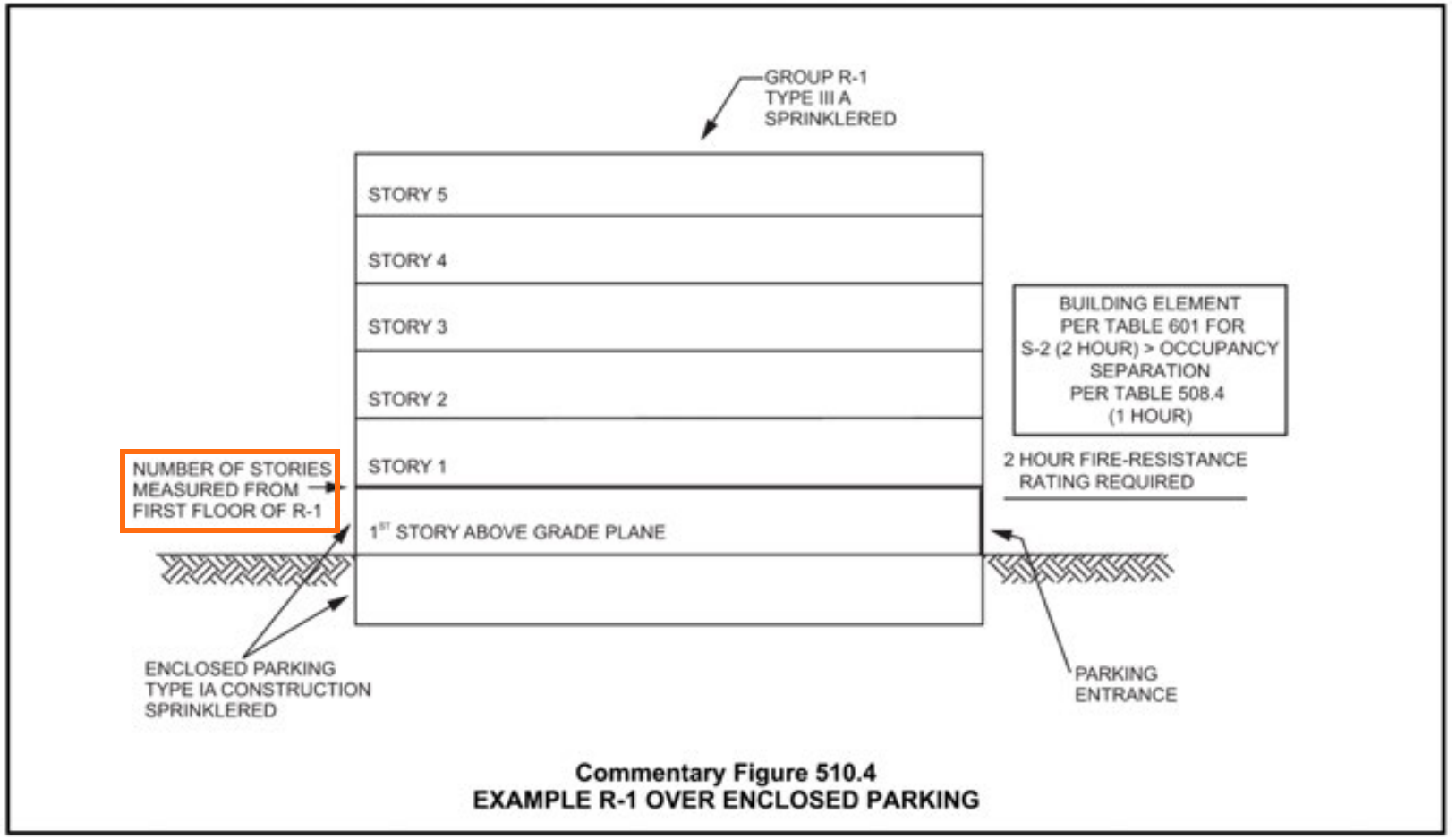
Parking beneath Group R (IBC 510.4)

- Group R building stories measured from podium *if*:
  - Lowest above grade level is parking (S-2)
  - Lowest level and floor above is Type I or IV construction
  - Group R occupancy above
  - Horizontal assembly between parking and residential per IBC 508.4 (mixed occupancy separation)

North Commons Residences / Grugnale Properties / Annino Incorporated / Gregory Folkins

Mixed Occupancy Buildings: Special Provisions

Parking beneath Group R (IBC 510.4)



Commentary Figure 510.4
EXAMPLE R-1 OVER ENCLOSED PARKING

Mixed Occupancy Buildings: Special Provisions

Group R-1 / R-2, Type III-A buildings height / story increase (IBC 510.5)

- 1-story / 10-foot height increase *if*:
  - Building above is Type III-A and Groups R-1/R-2
  - Basement and above-grade construction separated by 3-hr FRR horizontal assembly
  - Floor areas subdivided into areas ≤ 3,000 sf using 2-hr FRR fire walls

Carroll at Bellemeade – Greensboro NC / The Carroll Companies / Greg Folkins

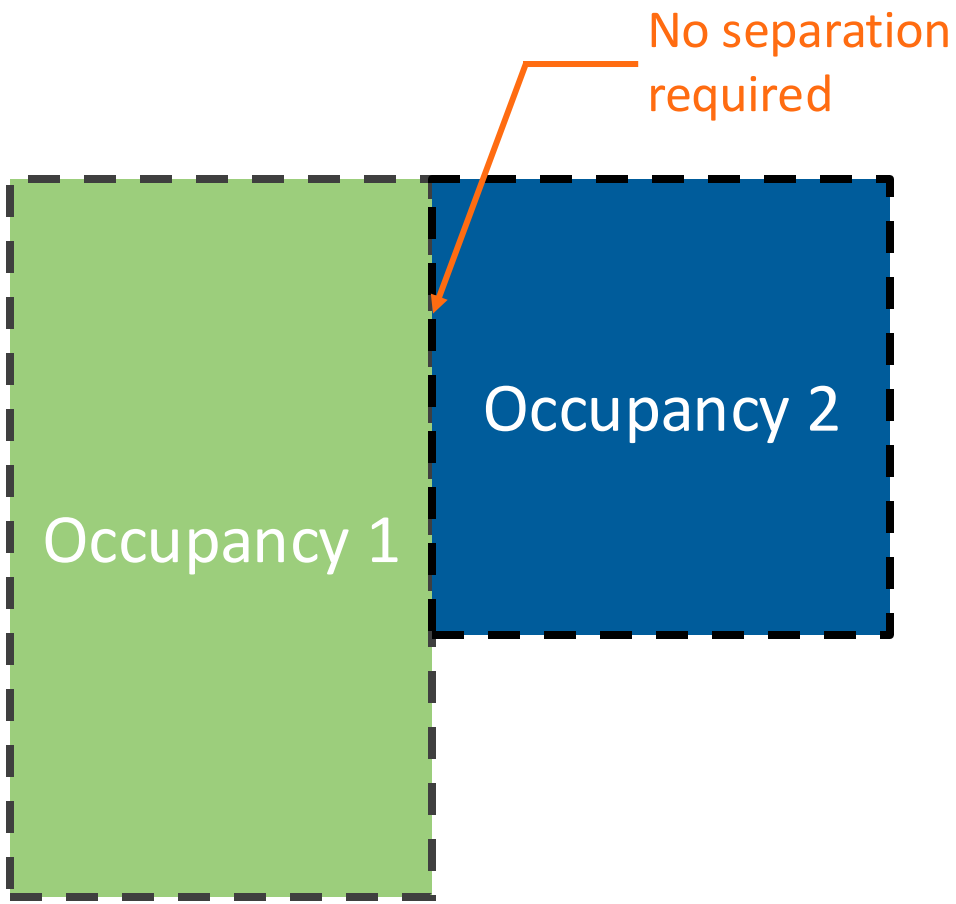
Mixed Occupancy Buildings: Nonseparated Occupancies

Washington Place / Joseph Tatone & Associates / Gregory Folkins

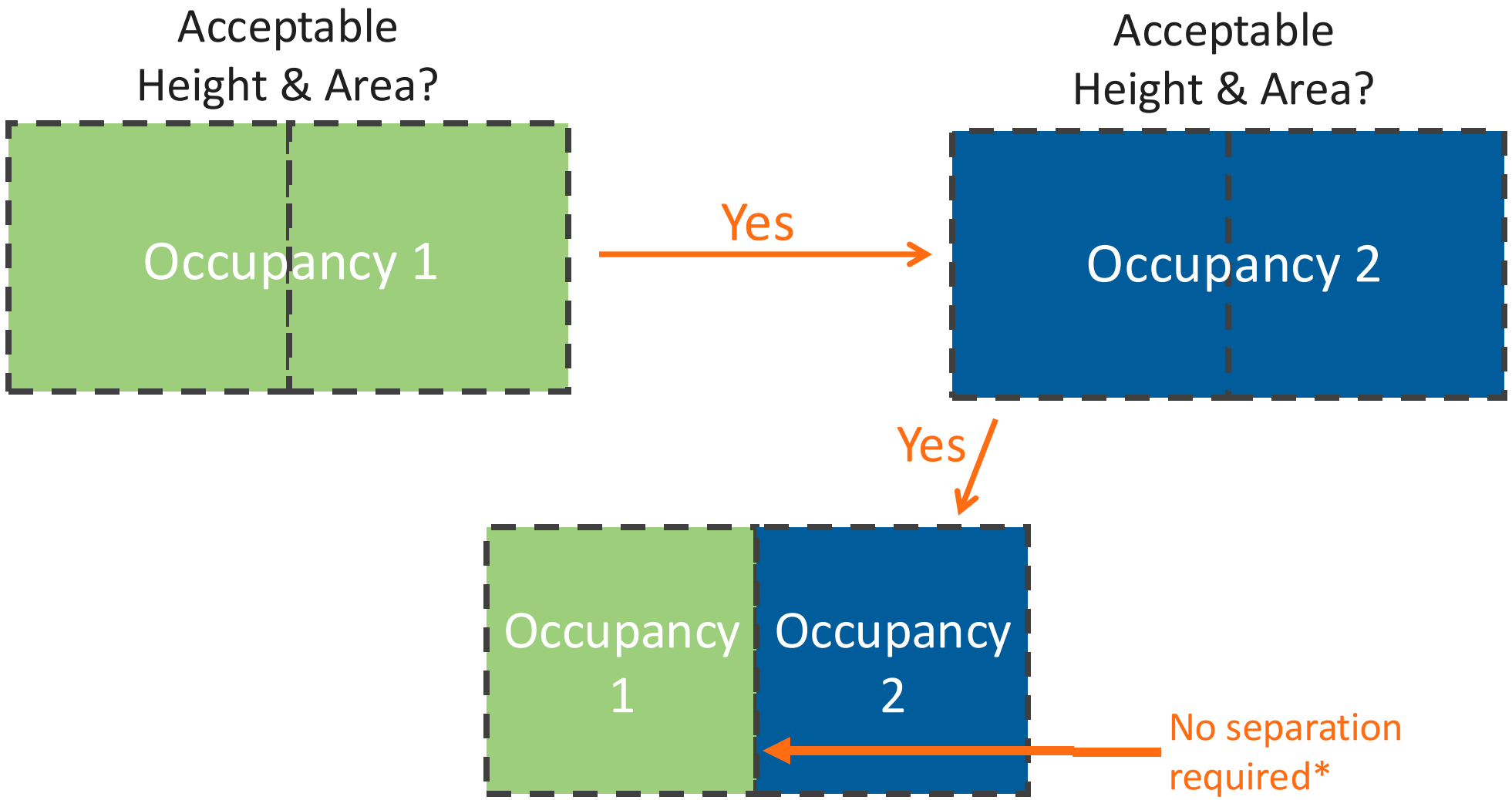
Mixed Occupancy Buildings: Nonseparated Occupancies

Nonseparated occupancies (IBC 508.3)

- No fire separation between occupancies (except hazardous or when otherwise required)
  - Allowable heights, areas and fire protection based on most restrictive of **all** occupancies
  - Other requirements (egress, etc.) based on **each** occupancy

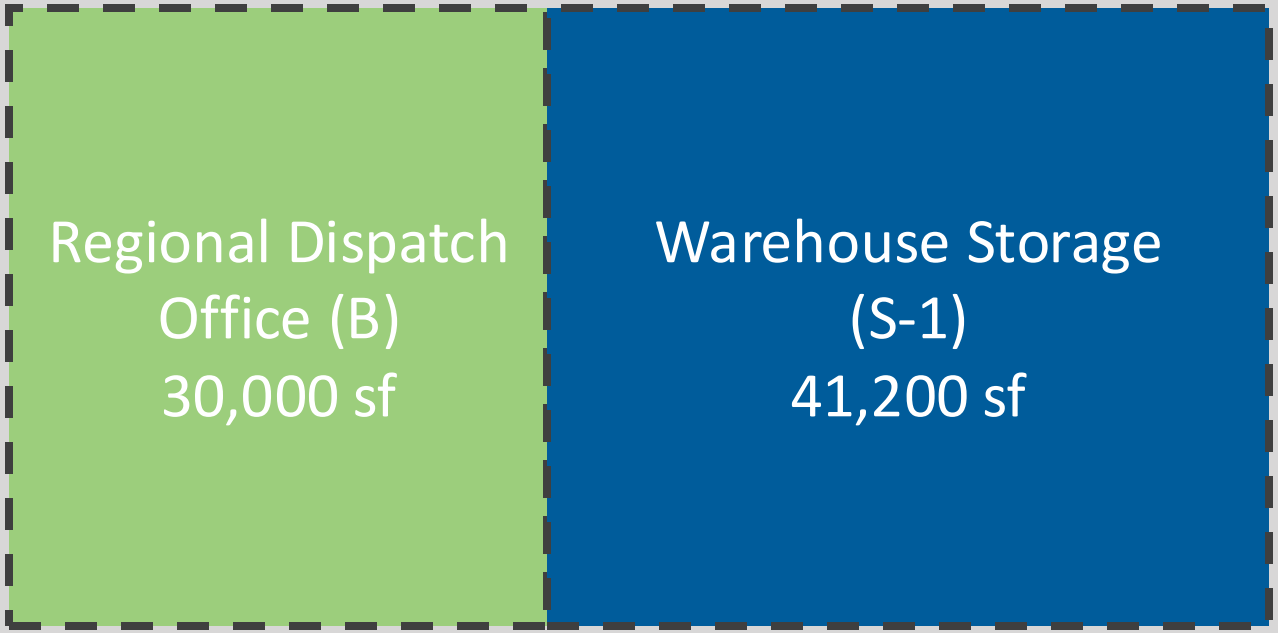


Mixed Occupancy Buildings: Nonseparated Occupancies



Mixed Occupancy Buildings: Nonseparated Occupancies

Example: Nonseparated Occupancies



Total building area = 71,200 sf

- 1-story building
- Sprinklers per IBC 903:
  - Not required for Group B
  - Required for Group S-1 if fire area > 12,000 sf

→ NFPA 13 sprinklers required throughout building

Mixed Occupancy Buildings: Nonseparated Occupancies

Example: Nonseparated Occupancies

Total building area = 71,000 sf

- Construction type options:
  - V-B: Not OK for B or S-1
  - V-A: OK for B, not OK for S-1
  - III-B: OK for B, not OK for S-1
  - **III-A: OK for both**

Allowable 1-Story Area (Table 506.2)				
	III-A	III-B	V-A	V-B
Group B	114k sf	76k sf	72k sf	~~36k sf~~
Group S-1	104k sf	~~70k sf~~	~~56k sf~~	~~36k sf~~

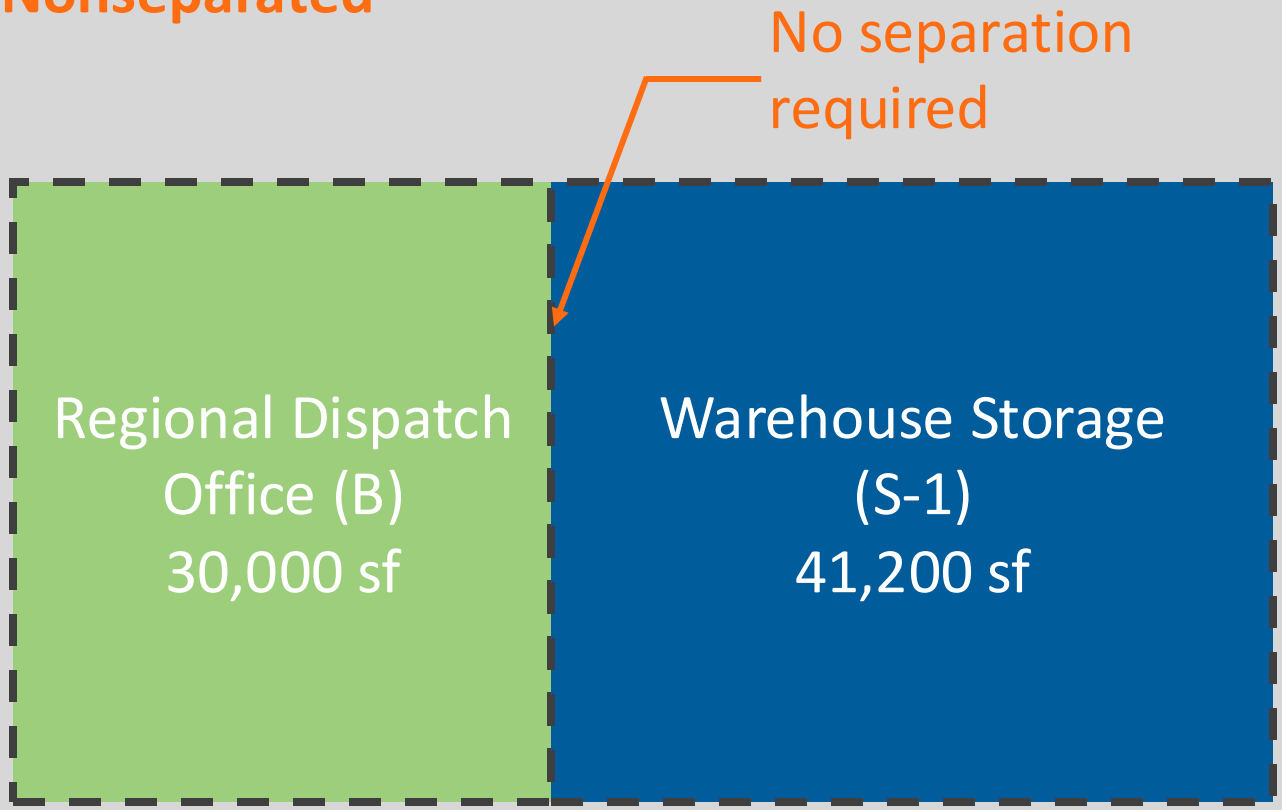
Assumptions: NFPA 13 sprinkler, No frontage increase

Mixed Occupancy Buildings: Nonseparated Occupancies

Example: Nonseparated Occupancies

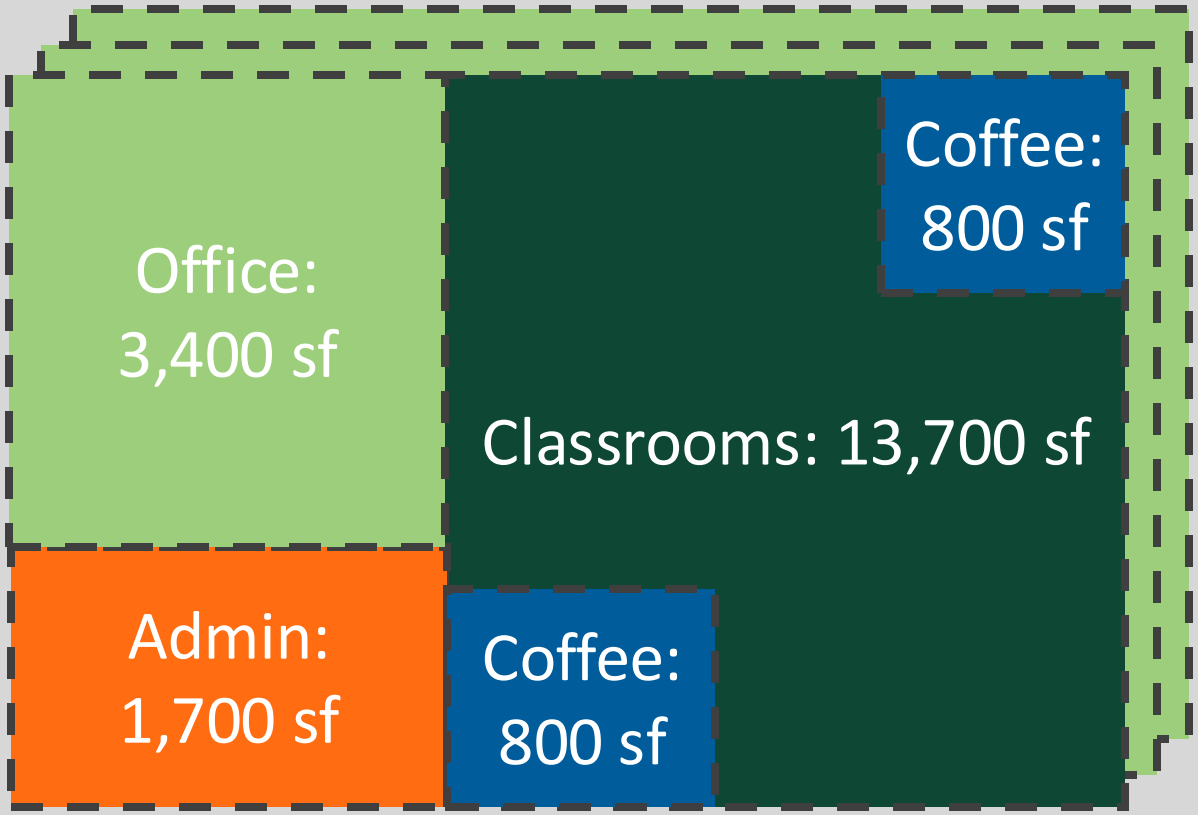
Total building area = 71,000 sf

→ **Use Type III-A Nonseparated**



Mixed Occupancy Buildings: Nonseparated Occupancies

Example: Multi-Story Nonseparated Occupancies



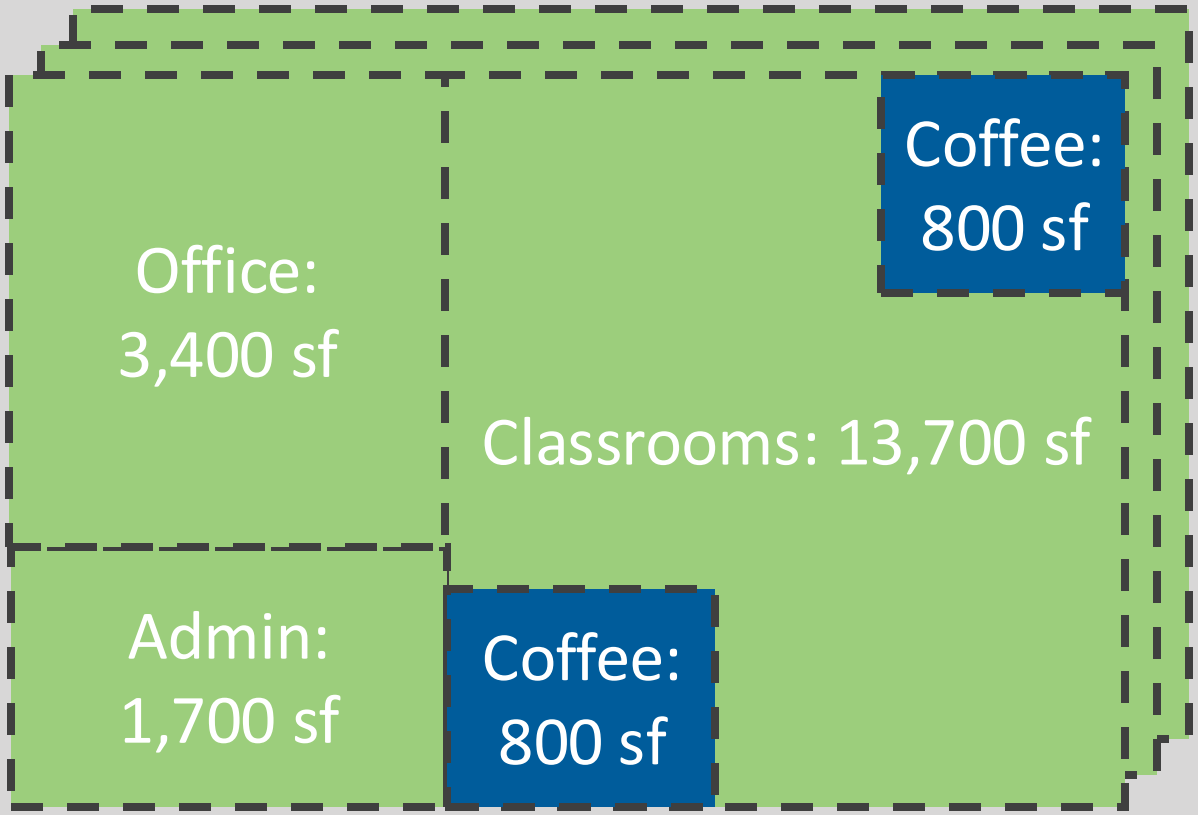
Totals: 20,400 sf/floor
61,200 sf total

- 3-story building on college campus
- NFPA 13 sprinkler required throughout

- 1st floor:
  - (2) 800 sf coffee/snack bars
  - 13,700 sf classrooms
  - 3,400 sf offices
  - 1,700 sf admin
- 2nd and 3rd floors: 20,400 sf office

Mixed Occupancy Buildings: Nonseparated Occupancies

Example: Multi-Story Nonseparated Occupancies



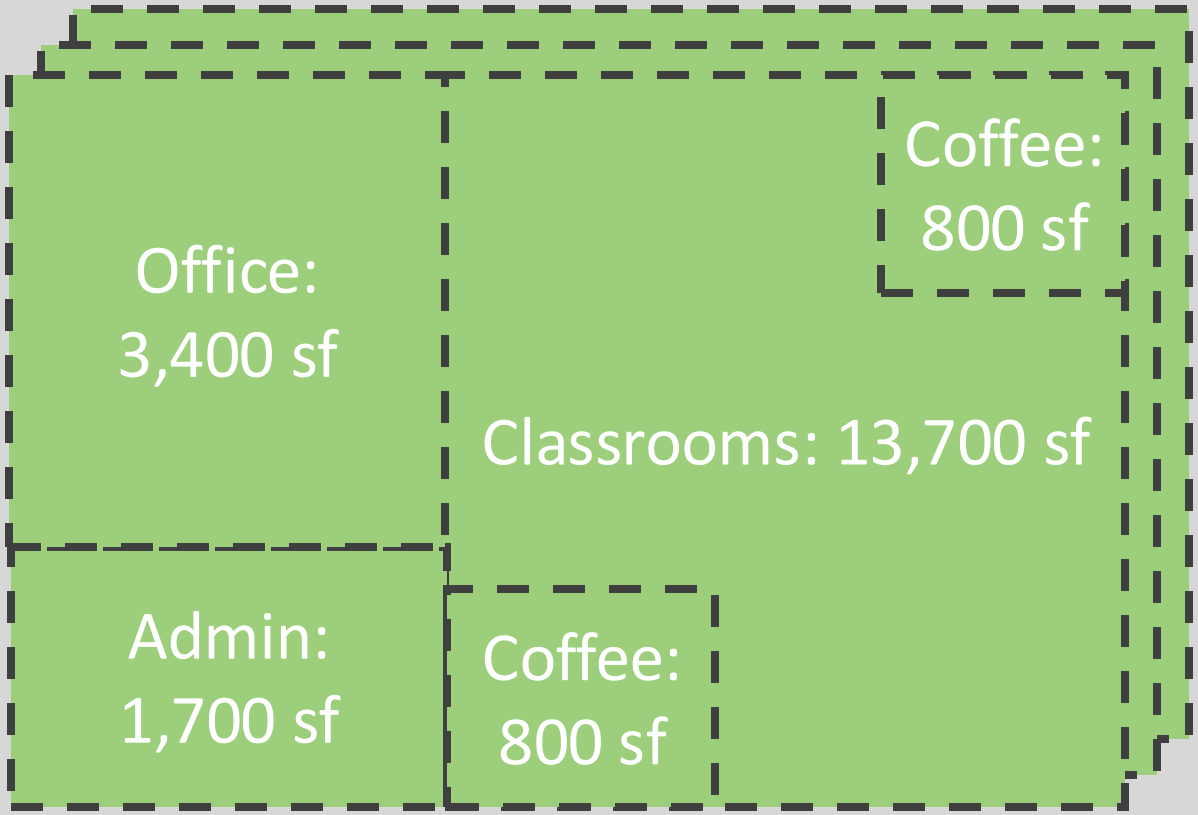
Totals: 20,400 sf/floor
61,200 sf total

Occupancies:

- Admin and offices: Group B
- Classrooms for > 12th grade: Group B
- Coffee / snack bar: Group A-2
  - Small assembly space? (Group B)
  - Accessory occupancy? (Group B)

Mixed Occupancy Buildings: Nonseparated Occupancies

Example: Multi-Story Nonseparated Occupancies



Totals: 20,400 sf/floor
61,200 sf total

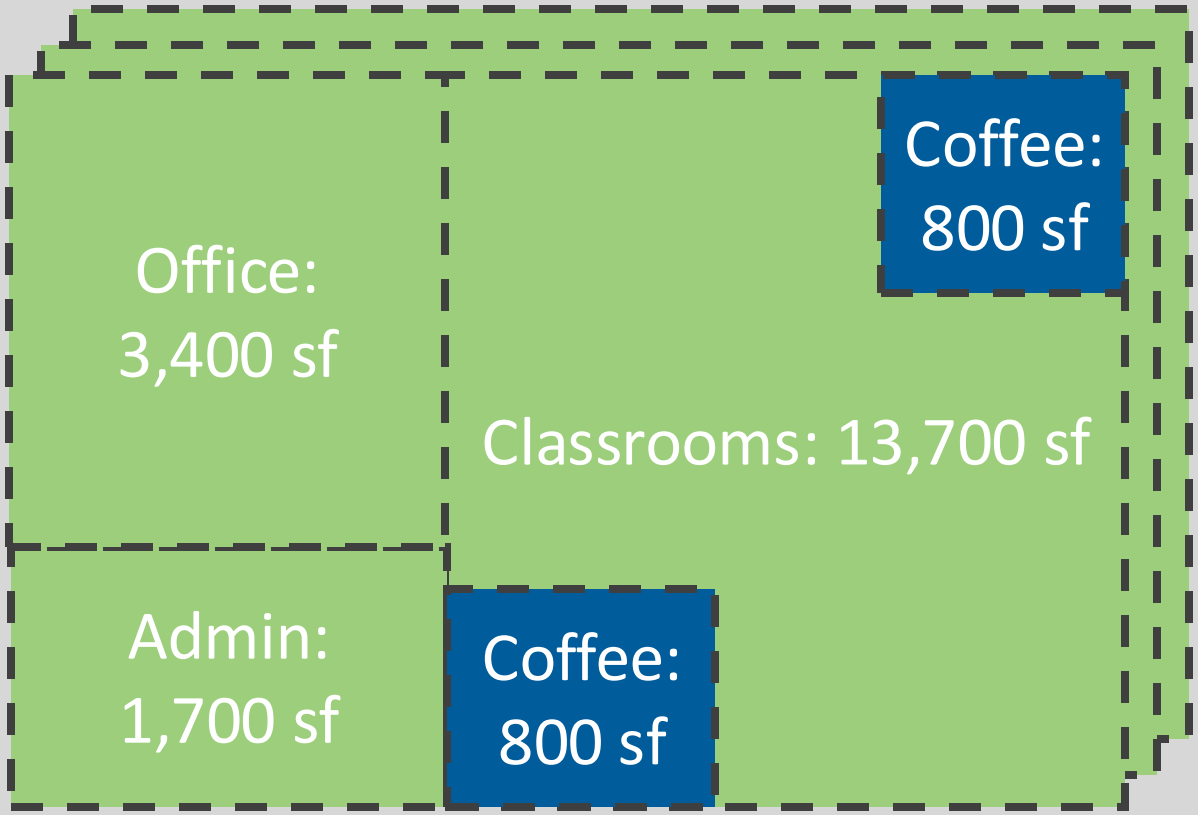
- Assume coffee / snack areas qualify for small assembly or accessory occupancy
  - Entire building is Group B

→ **Use Type V-B construction**

Group B Allowable Heights and Areas		
	Height	Area
Type V-B	3 stories 60 ft	27k sf/floor 81k sf total

Mixed Occupancy Buildings: Nonseparated Occupancies

Example: Multi-Story Nonseparated Occupancies



Totals: 20,400 sf/floor
61,200 sf total

- Assume Group A-2 for coffee areas
  - Building includes Groups B and A-2
  - Group B OK, check Group A-2

→ **Use Type V-A construction**

Group A-2 Allowable Heights and Areas		
	Height	Area
Type V-A	3 stories 70 ft	34.5k sf/floor 103.5k sf total
Type V-B	~~2 stories~~ ~~60 ft~~	~~18k sf/floor~~ ~~54k sf total~~

Mixed Occupancy Buildings: Separated Occupancies

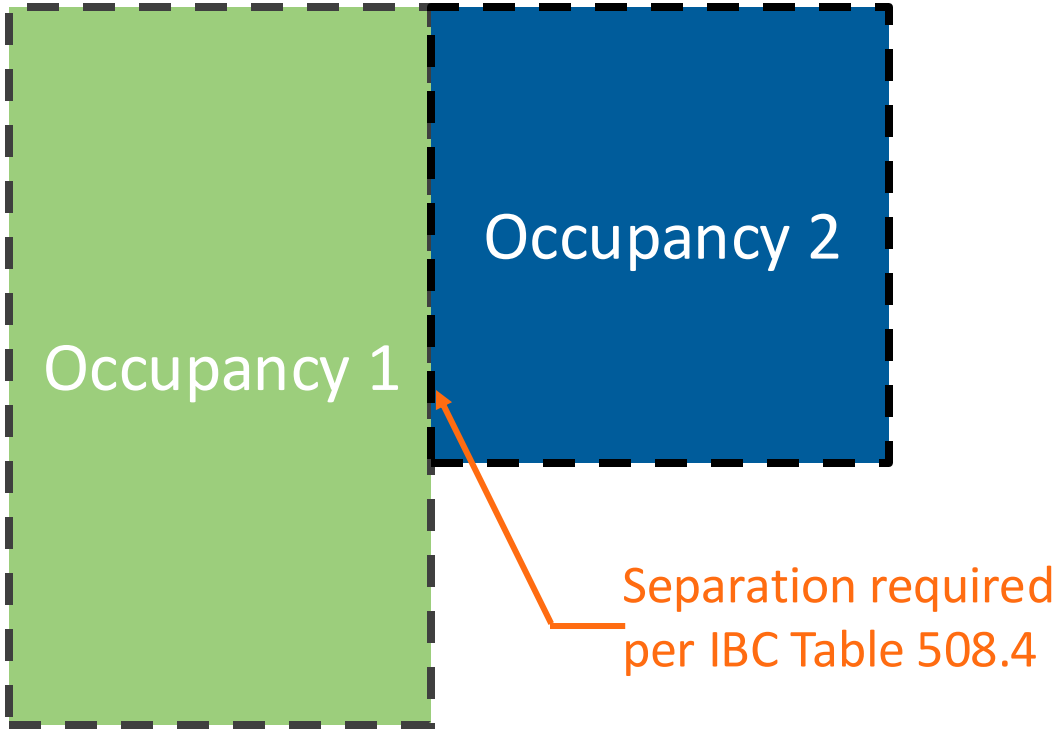
INTRO Cleveland / Hartshorne Plunkard Architecture / Forefront Structural Engineers / Fast + Epp / photo Nick Johnson, Tour D Space

Mixed Occupancy Buildings: Separated Occupancies

Separated occupancies (IBC 508.4)

- Fire resistance rated separation between occupancies
  - Code requirements for each portion based on occupancy of that portion
  - Allowable height: Based on construction type and occupancy
  - Allowable area: Ratios of allowable area used to check each story

$$\frac{A_{occup1}}{A_{allow,occup1}} + \frac{A_{occup2}}{A_{allow,occup2}} \leq 1.0$$



Mixed Occupancy Buildings: Separated Occupancies

Occupancy Separation (IBC Table 508.4)

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)[f]

OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], 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	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	1	2	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	2	NP	2	NP	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	1	2	1	NP	2	NP	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	N	1	1	2	2	NP	1[c]	2[c]	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	1	2	1	2	2	NP	1	2	1	2	N	N	NP	NP	2	3	1	2	1	NP
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	3	NP	3	NP	3	NP	3	4	2	3	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP	2	NP	2	3	1	2	NP	NP	1	NP	1[d]	NP	1	NP
H-5	2	NP	2	NP	2	NP	2	NP	2	NP	1	NP	NP	NP	1	NP	1	NP	N	NP

- S: Sprinklered
- NS: No Sprinklers

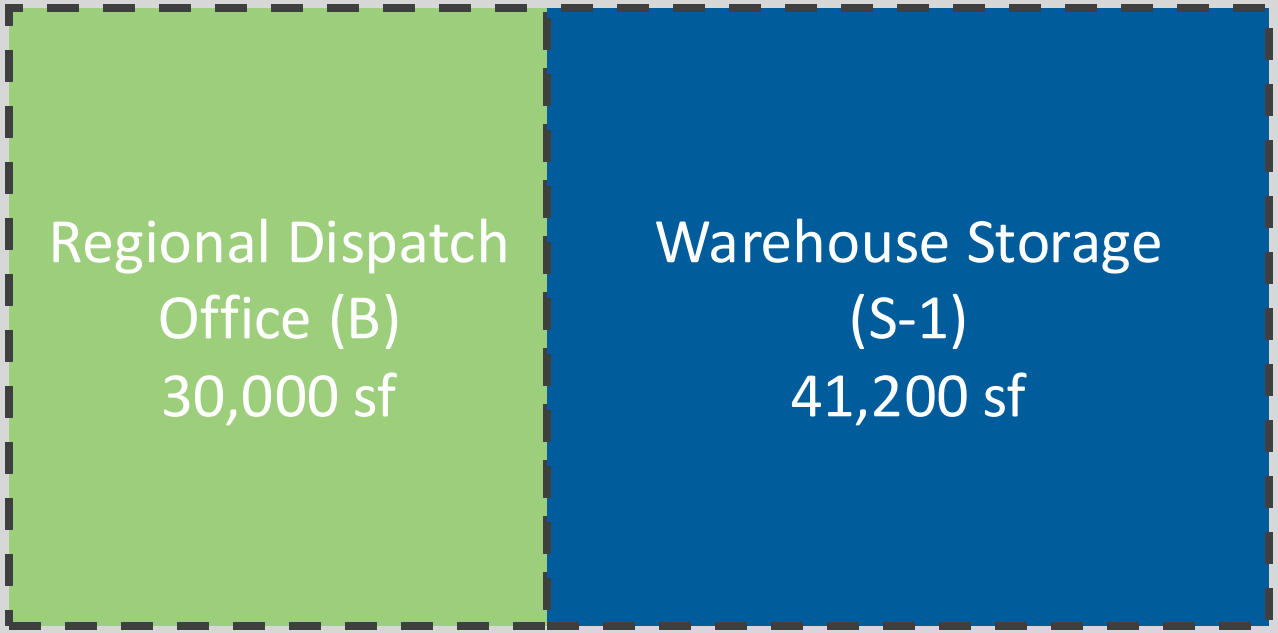
- **1, 2, 3**: FRR protection
- **NP**: Not Permitted
- **N**: No Separation Required

Separation accomplished with:

- Walls: fire barriers (IBC 707)
- Floors: horizontal assemblies (IBC 711)

Mixed Occupancy Buildings: Separated Occupancies

Example: Separated Occupancies



Total building area = 71,200 sf

- 1-story building
- Sprinklers per IBC 903:
  - Not required for Group B
  - Required for Group S-1 if fire area > 12,000 sf

→ NFPA 13 sprinklers required throughout building

Mixed Occupancy Buildings: Separated Occupancies

Example: Separated Occupancies

Areas of occupancies:

- Office (B): 30,000 sf
- Storage (S-1): 41,200 sf

Allowable 1-Story Area (Table 506.2)				
	III-A	III-B	V-A	V-B
Group B	114k sf	76k sf	72k sf	36k sf
Group S-1	104k sf	70k sf	56k sf	36k sf

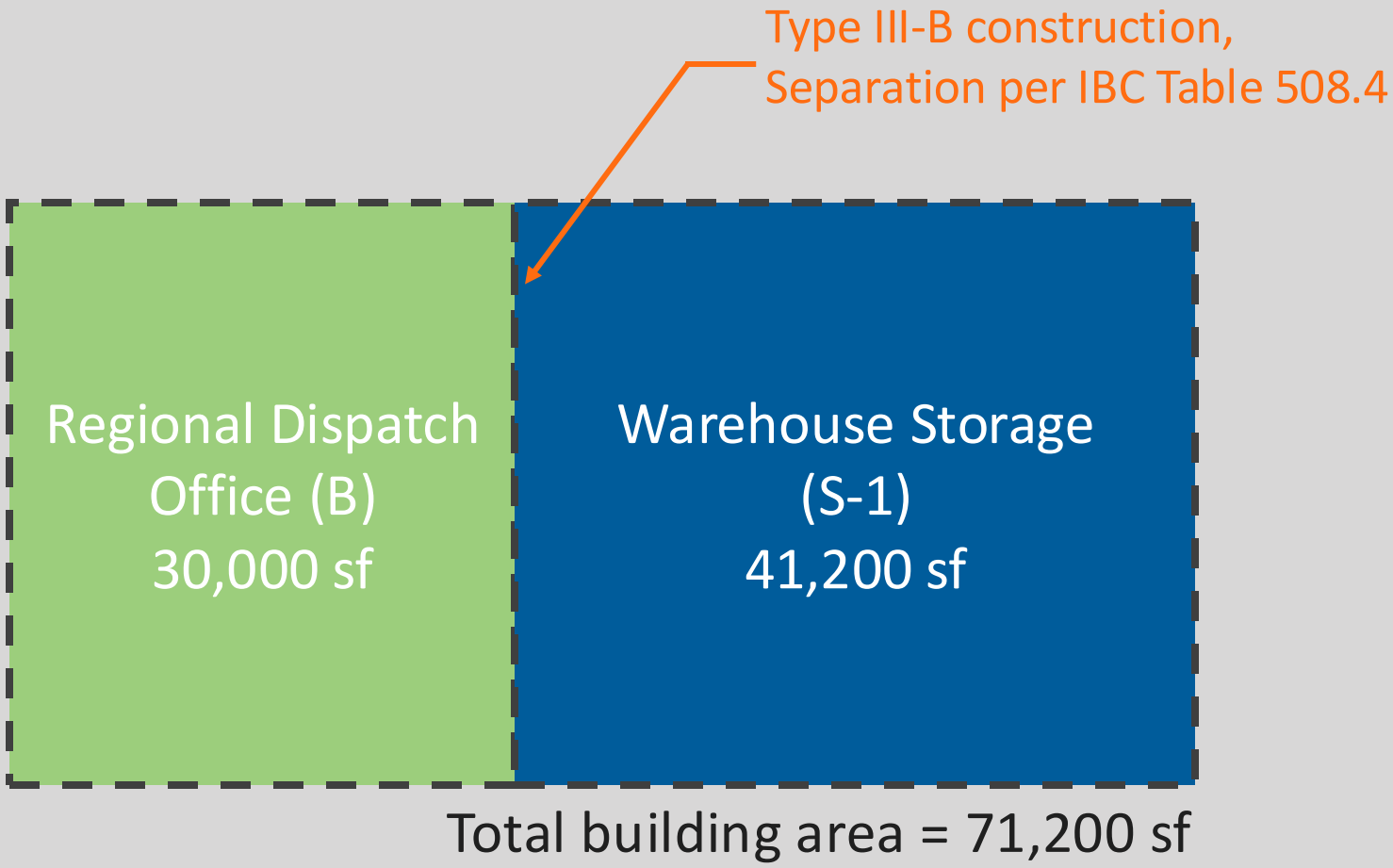
Assumptions: NFPA 13 sprinkler, No frontage increase

Construction type options:

- V-B: $\frac{30{,}000}{36{,}000} + \frac{41{,}200}{36{,}000} = 1.98 > 1.0$
- V-A: $\frac{30{,}000}{72{,}000} + \frac{41{,}200}{56{,}000} = 1.15 > 1.0$
- III-B: $\frac{30{,}000}{76{,}000} + \frac{41{,}200}{70{,}000} = 0.98 < 1.0$ → **Use Type III-A construction**

Mixed Occupancy Buildings: Separated Occupancies

Example: Separated Occupancies



Mixed Occupancy Buildings: Separated Occupancies

Example: Separated Occupancies

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)[f]

OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], 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	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	1	2	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	2	NP	2	NP	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	1	2	1	NP	2	NP	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	N	1	1	2	2	NP	1[c]	2[c]	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	1	2	1	2	2	NP	1	2	1	2	N	N	NP	NP	2	3	1	2	1	NP
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	3	NP	3	NP	3	NP	3	4	2	3	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP	2	NP	2	3	1	2	NP	NP	1	NP	1[d]	NP	1	NP
H-5	2	NP	2	NP	2	NP	2	NP	2	NP	1	NP	NP	NP	1	NP	1	NP	N	NP

No separation required

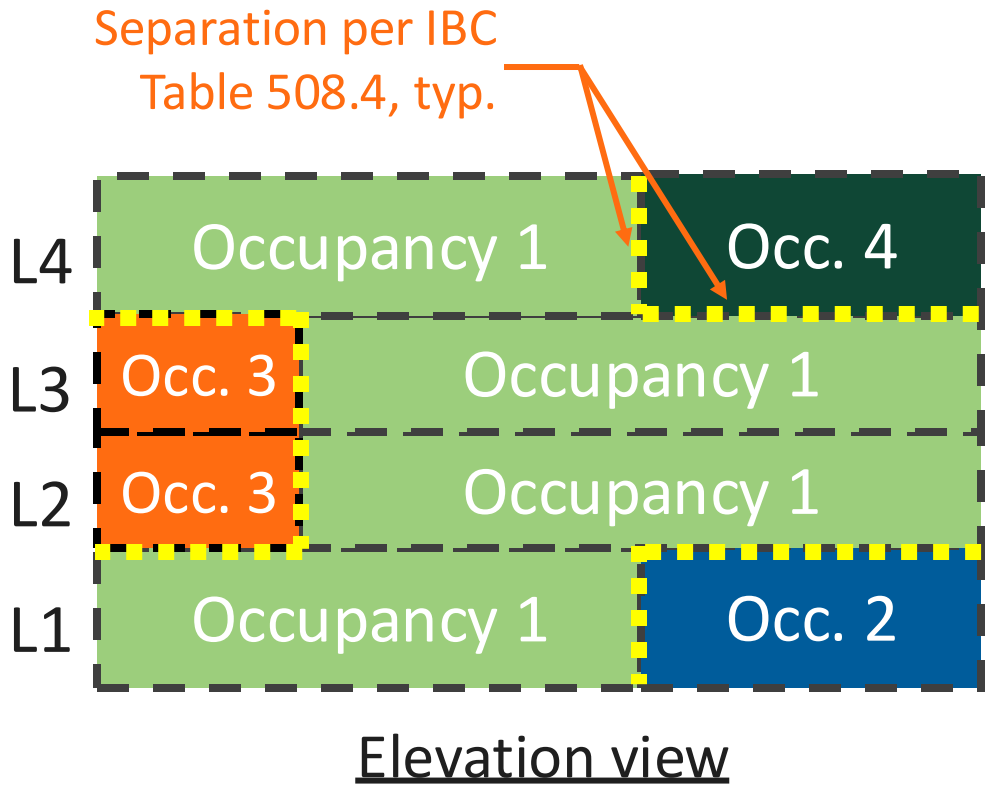
Mixed Occupancy Buildings: Separated Occupancies

Multi-story separated occupancies (IBC 508.4)

- Allowable areas ratios
  - Check allowable area ratios for each story

$$\frac{A_{occup1}}{A_{allow,occup1}} + \frac{A_{occup2}}{A_{allow,occup2}} \leq 1.0$$

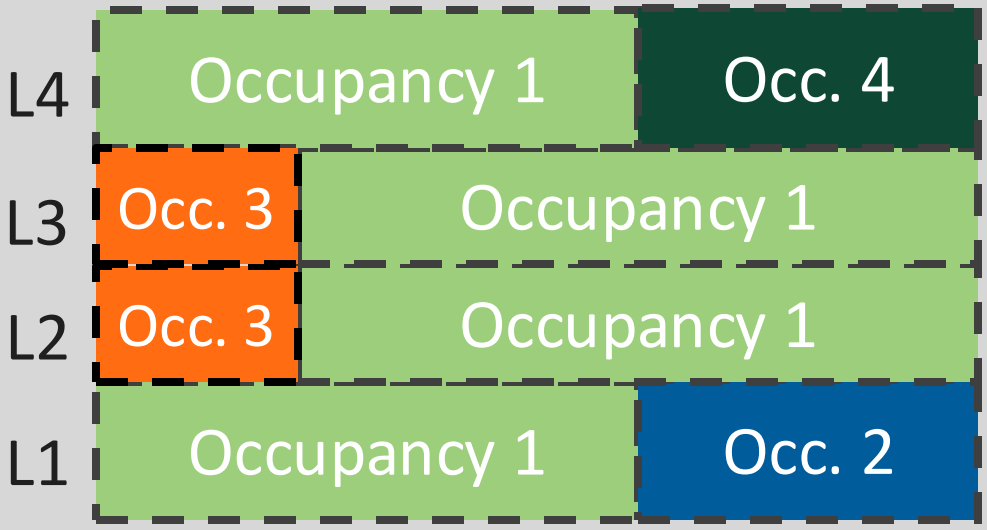
  - Sum of ratios for all floors
    - 1-story building: ≤ 1.0
    - 2-story building: ≤ 2.0
    - 3+ story building: ≤ 3.0



Elevation view

Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies



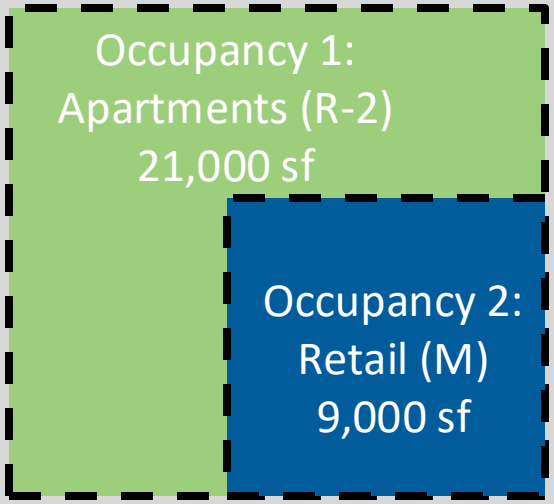
Elevation view

- 4-story building
- Sprinklers required throughout for buildings containing Group R (IBC 903.2.8)
  - Provide NFPA 13 sprinklers
- Total building area = 120,000 SF
  - Occupancy 1 = Apartments (R-2)
  - Occupancy 2 = Retail (M)
  - Occupancy 3 = Restaurant (A-2)
  - Occupancy 4 = Offices (B)

Mixed Occupancy Buildings: Separated Occupancies

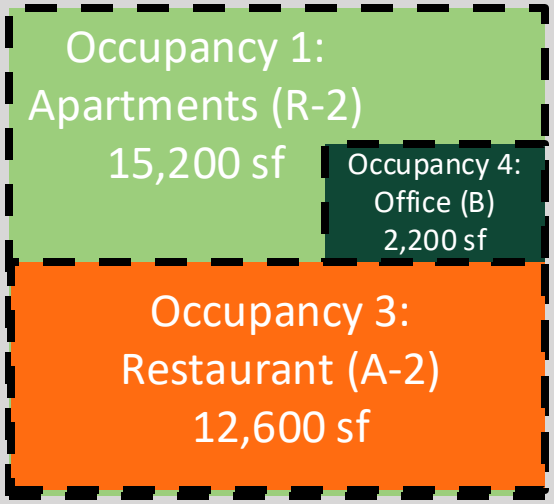
Example: Multi-Story Separated Occupancies

Level 1 Floor Plan

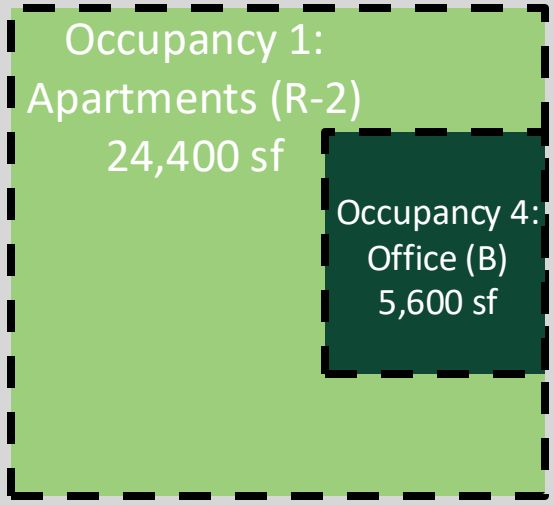


Level 2 Floor Plan

Level 3 Floor Plan



Level 4 Floor Plan



Mixed Occupancy Buildings: Separated Occupancies

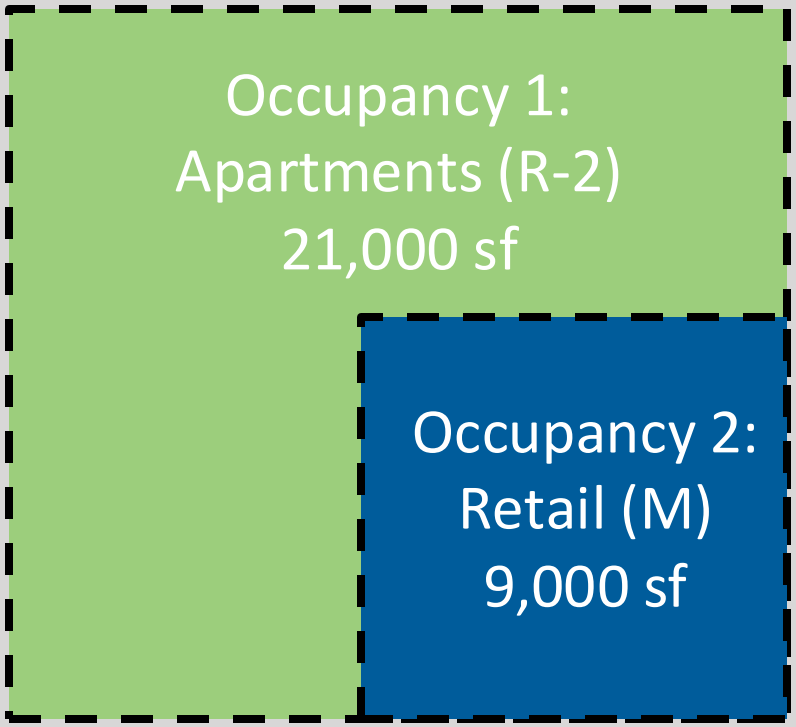
Example: Multi-Story Separated Occupancies

Allowable Floor Area and Stories (Tables 504.4 and 506.2)				
	III-A	III-B	V-A	V-B
Group A-2	42,000 sf 4 stories	28,500 sf 3 stories	34,500 sf 3 stories	18,000 sf 2 stories
Group B	85,500 sf 6 stories	57,000 sf 4 stories	54,000 sf 4 stories	27,000 sf 3 stories
Group M	55,500 sf 5 stories	37,500 sf 3 stories	42,000 sf 4 stories	27,000 sf 2 stories
Group R-2	72,000 sf 5 stories	48,000 sf 5 stories	36,000 sf 4 stories	21,000 sf 3 stories

Assumes NFPA 13 sprinklers, no frontage increase

Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies



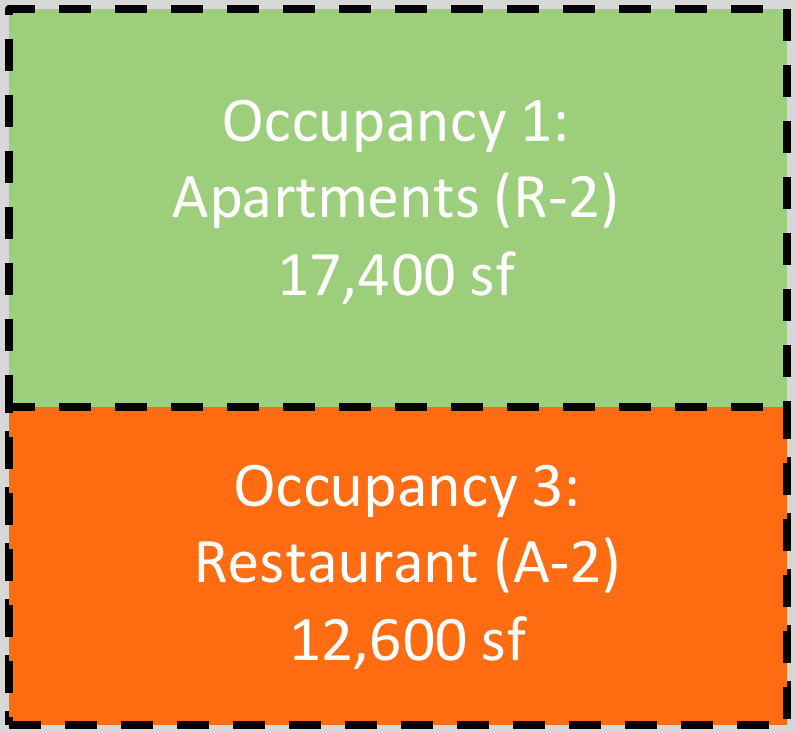
Level 1

Level 1:

- Try Type V-A:
  - Allowable area:
    - $\frac{21{,}000}{36{,}000} + \frac{9{,}000}{42{,}000} = 0.8 < 1.0 \rightarrow$ OK
  - Allowable heights / stories:
    - R-2: 70 ft, 4 stories → OK
    - M: 70 ft, 4 stories → OK

Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies



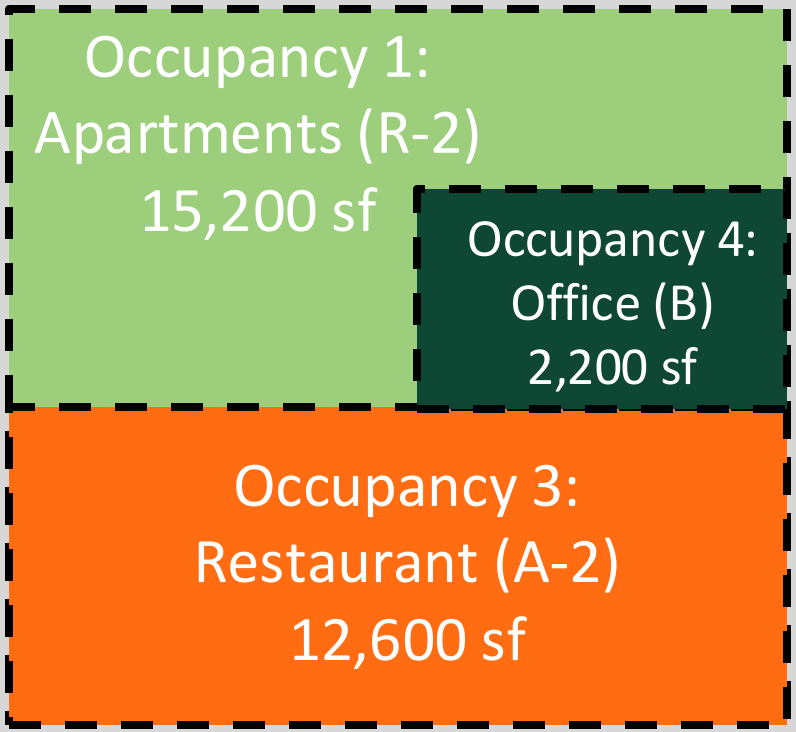
Level 2

Level 2:

- Try Type V-A:
  - Allowable area:
    - $\frac{17{,}400}{36{,}000} + \frac{12{,}600}{34{,}500} = 0.85 < 1.0 \rightarrow$ OK
  - Allowable heights / stories:
    - R-2: 70 ft, 4 stories → OK
    - A-2: 70 ft, 3 stories → OK

Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies



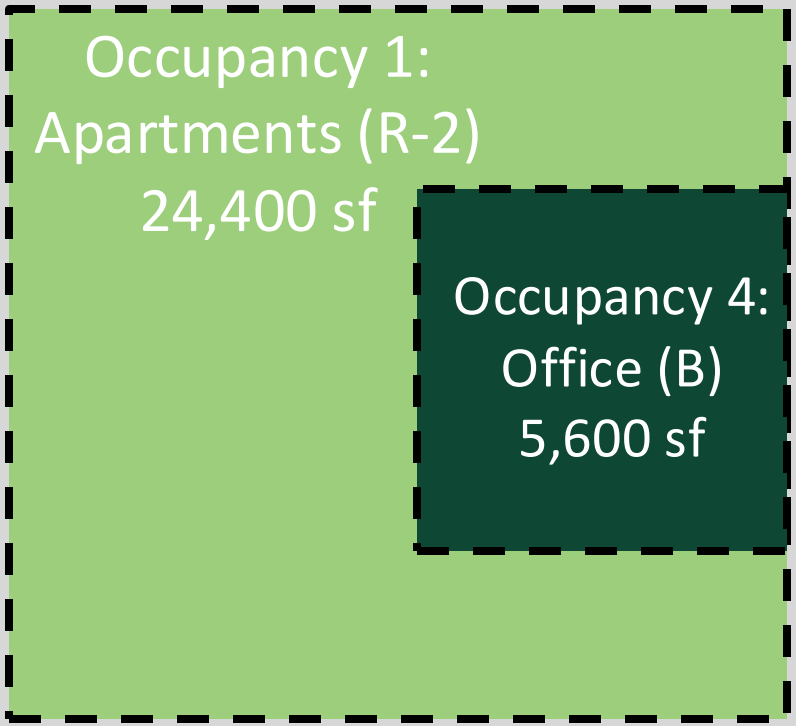
Level 3

Level 3:

- Try Type V-A:
  - Allowable area:
    - $\frac{15{,}200}{36{,}000} + \frac{12{,}600}{34{,}500} + \frac{2{,}200}{54{,}000} = 0.83 < 1.0$ →OK
  - Allowable heights / stories:
    - R-2: 70 ft, 4 stories → OK
    - A-2: 70 ft, 3 stories → OK
    - B: 70 ft, 4 stories → OK

Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies



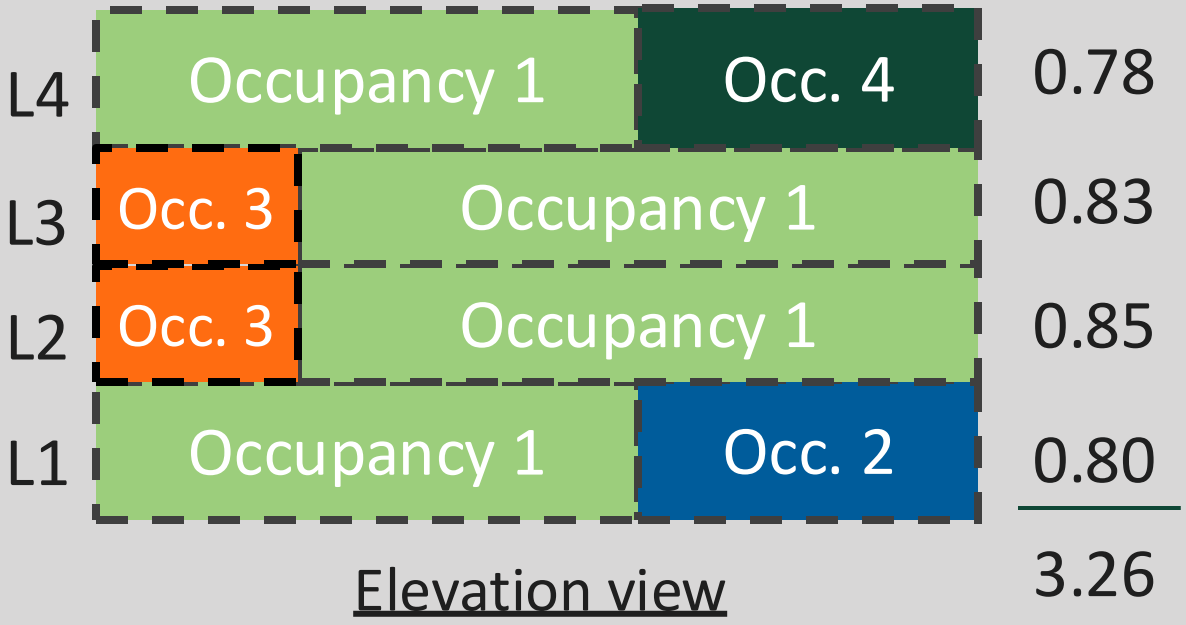
Level 4

Level 4:

- Try Type V-A:
  - Allowable area:
    - $\frac{24{,}400}{36{,}000} + \frac{5{,}600}{54{,}000} = 0.78 < 1.0 \rightarrow$ OK
  - Allowable heights / stories:
    - R-2: 70 ft, 4 stories → OK
    - B: 70 ft, 4 stories → OK

Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies



Elevation view

Check sum of area ratios:

- Sum = 3.26 > 3.0
  → Type V-A NOT OK

→ Use Type III-B

Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)[f]

OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], 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	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	1	2	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	2	NP	2	NP	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	1	2	1	NP	2	NP	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	N	1	1	2	2	NP	1[c]	2[c]	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	1	2	1	2	2	NP	1	2	1	2	N	N	NP	NP	2	3	1	2	1	NP
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	3	NP	3	NP	3	NP	3	4	2	3	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP	2	NP	2	3	1	2	NP	NP	1	NP	1[d]	NP	1	NP
H-5	2	NP	2	NP	2	NP	2	NP	2	NP	1	NP	NP	NP	1	NP	1	NP	N	NP

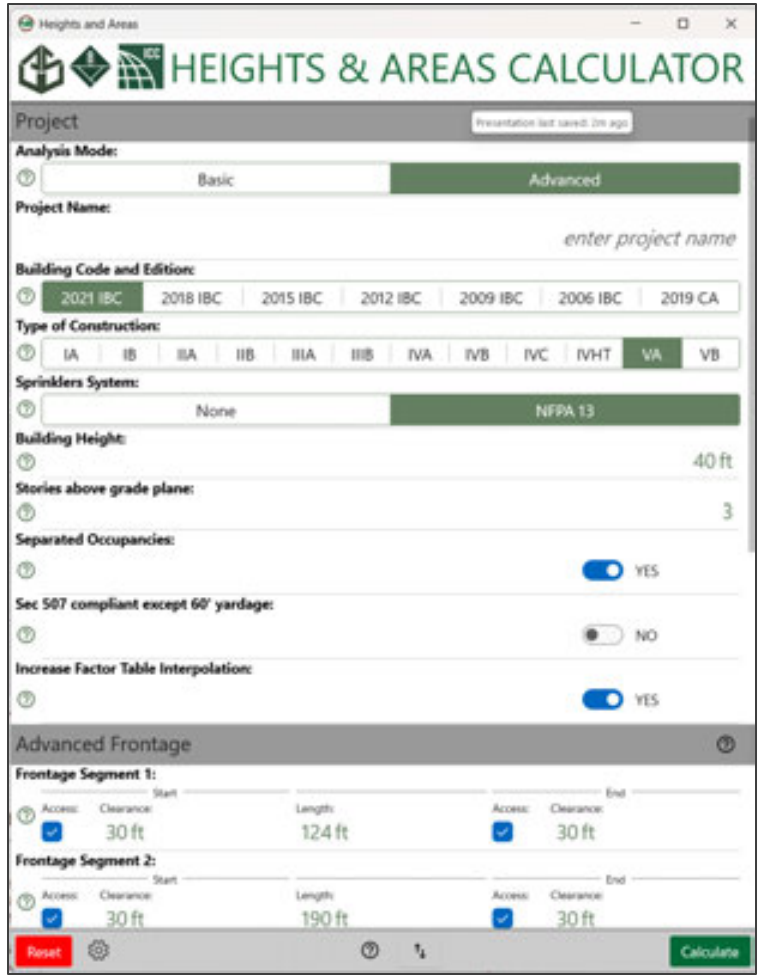
- R-2 to A-2, B, M: 1-hr walls and floors
- A-2 to M: 1-hr floor

Mixed Occupancy Buildings: Heights and Areas Calculator

Heights and areas calculator

- Free tool from AWC
- Checks separated and nonseparated occupancies

- https://www.woodworks.org/resources/heights-and-areas-calculator-app/



AWC Heights and Areas Calculator

Mixed Occupancy Buildings: Separated Occupancies

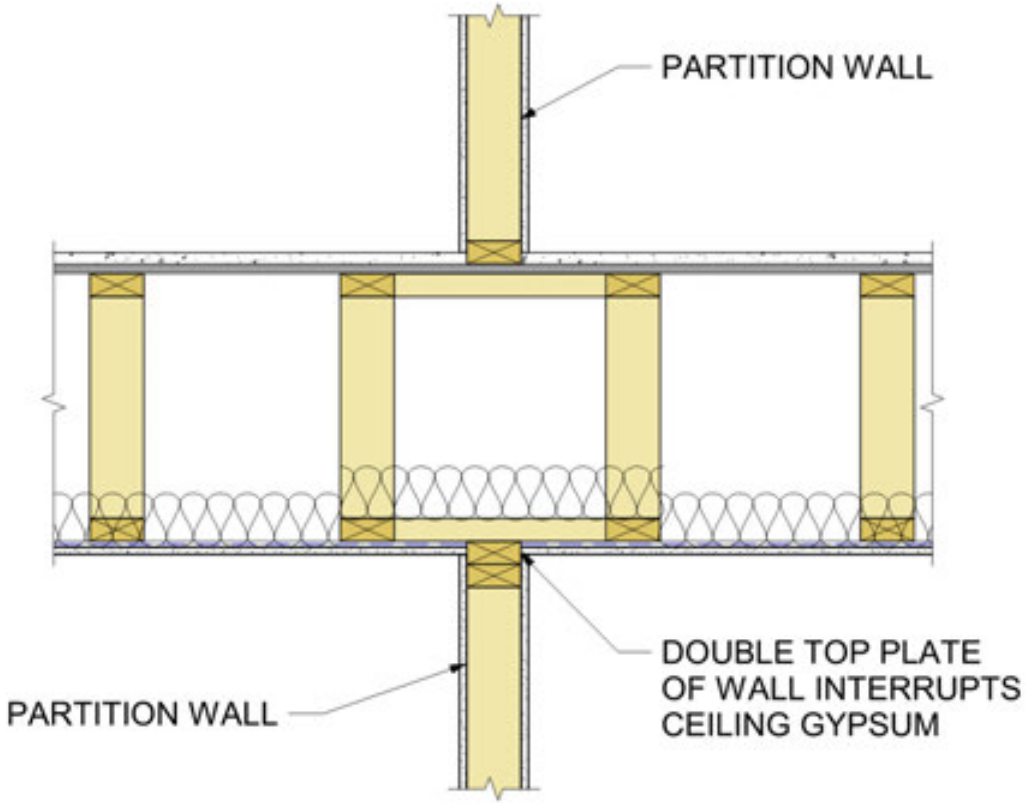
Floors: Horizontal Assemblies (IBC 711)

- Floor/roof assembly with FRR for occupancy/fire area separation
  - Per IBC Table 508.4 for occupancy separation
- Any materials permitted by construction type
- Continues, without vertical openings (except as permitted by IBC 712)
- Supporting construction has some FRR

Mixed Occupancy Buildings: Separated Occupancies

Can a wall interrupt the ceiling in a rated horizontal assembly?

- IBC 712.1.4 → IBC 714
- IBC 714.5.2, Exception 7: Ceiling interruptions allowed at walls *if*:
  - Wall has double wood top plate
  - Wall is sheathed with Type X gypsum



INTERIOR WALL TO FLOOR INTERSECTION

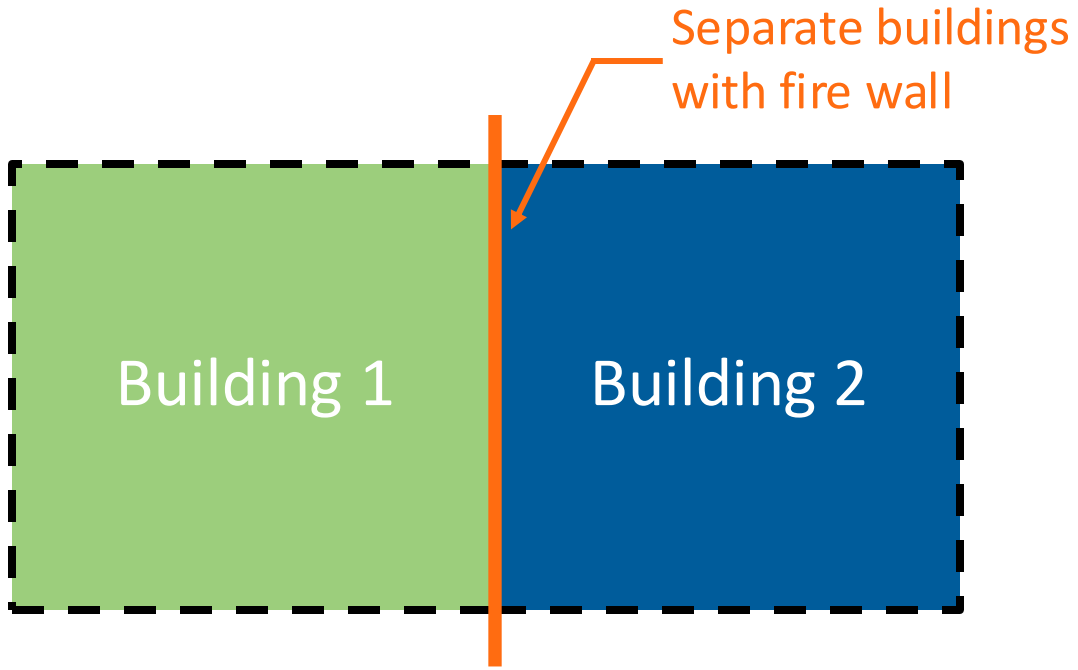
Mixed Occupancy Buildings: Separate Buildings

River Landing at Sandy Ridge – Colfax NC / Steel Group Architects / Greg Folkins

Mixed Occupancy Buildings: Separate Buildings

Use fire walls to create separate buildings (IBC 706)

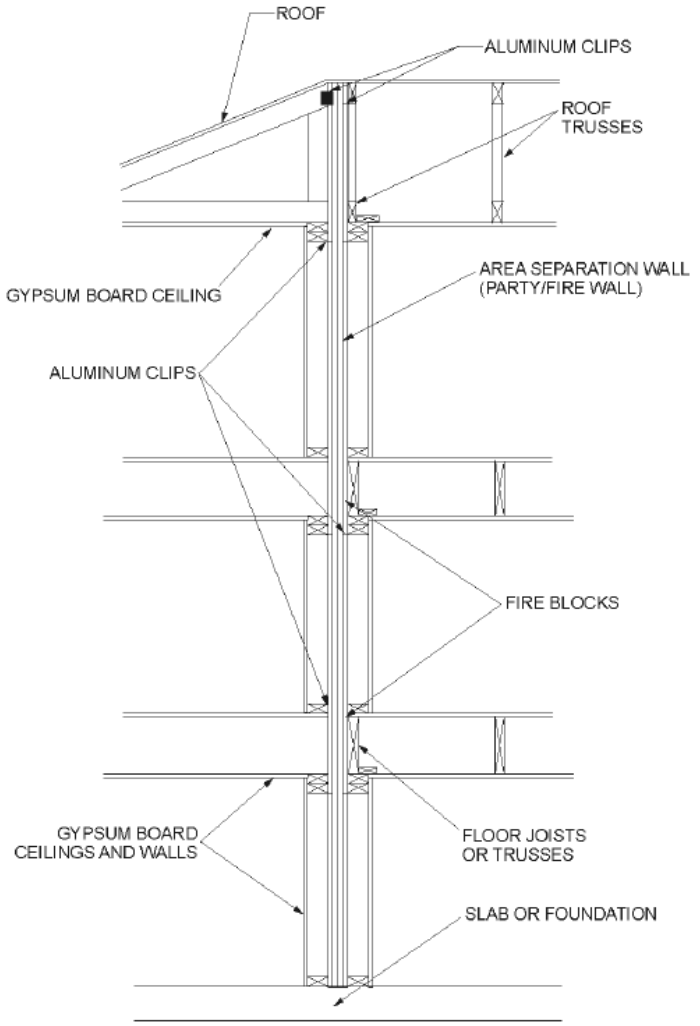
- Portions of building separated by fire walls
- Materials must be noncombustible (except in Type V construction)
- Hourly ratings per Table 706.4
- Protected openings
- Continuous from foundation to roof
- Structural stability considerations



Mixed Occupancy Buildings: Separate Buildings

Fire walls: Structural stability (IBC 706.2)

- In event of fire, structure on either side of wall can collapse without causing structure on opposite side to collapse
- Common options:
  - Cantilever walls
  - Laterally tied walls
  - Double walls



2021 IBC Code and Commentary – Volume 1, Commentary Figure 706.2(2)

Mixed Occupancy Buildings: Separate Buildings

Fire wall FRR (IBC Table 706.4)

TABLE 706.4
FIRE WALL FIRE-RESISTANCE RATINGS

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

a. In Type II or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.

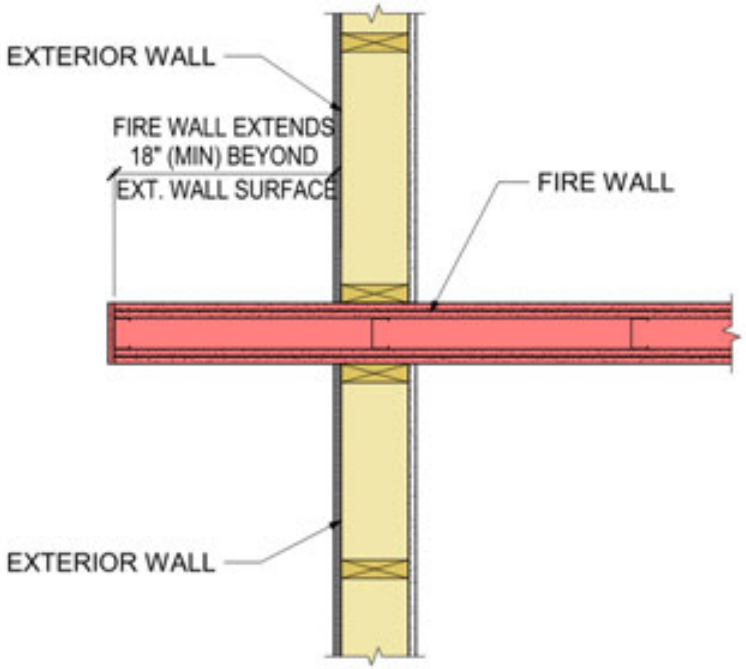
b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.7 and 415.8.

2021 International Building Code

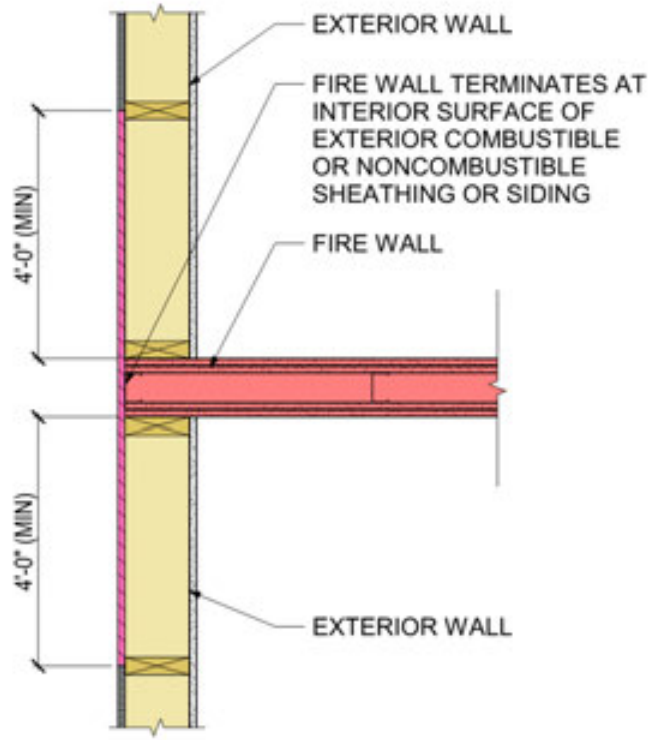
Mixed Occupancy Buildings: Separate Buildings

Fire walls: Horizontal continuity

- Fire walls continuous from exterior wall to exterior wall



FIRE WALL TO EXTERIOR WALL: OPTION 1

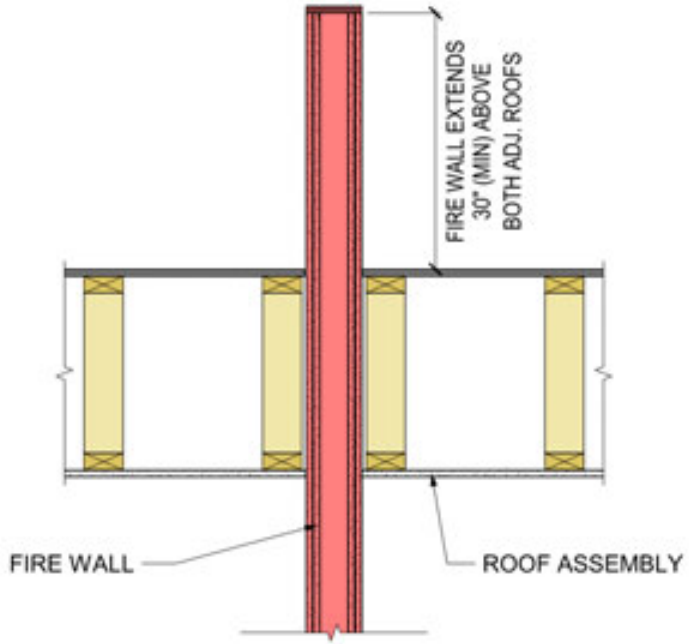


FIRE WALL TO EXTERIOR WALL: OPTION 2

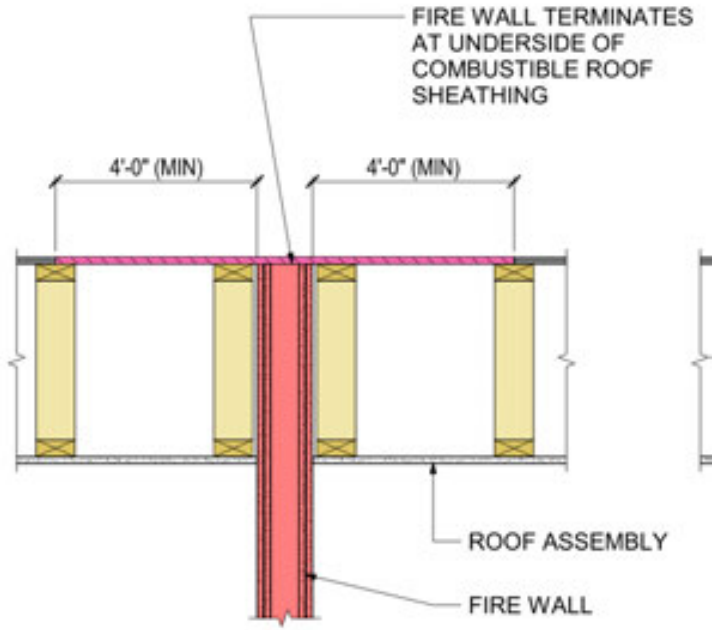
Mixed Occupancy Buildings: Separate Buildings

Fire walls: Vertical continuity

- Fire walls continuous from foundation to roof



FIRE WALL TO ROOF: OPTION 1

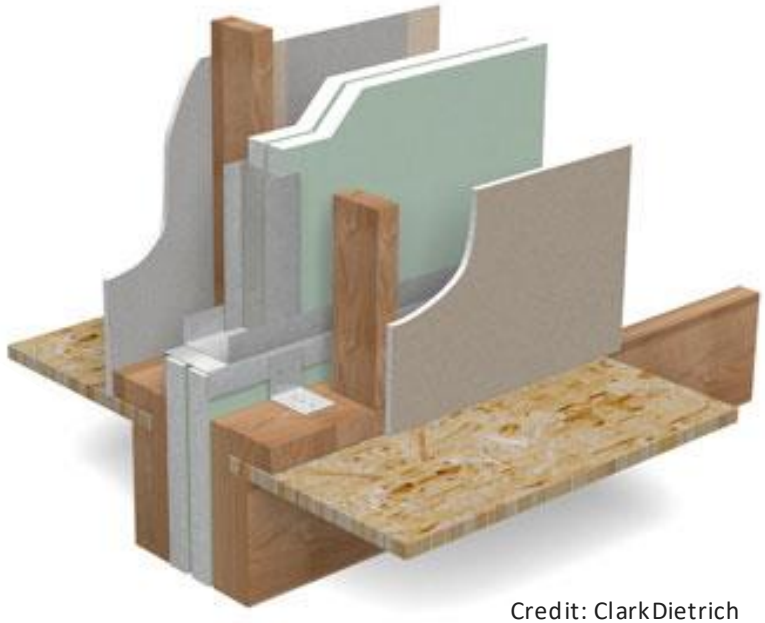


FIRE WALL TO ROOF: OPTION 2

Mixed Occupancy Buildings: Separate Buildings

Opportunity for wood-framed fire walls

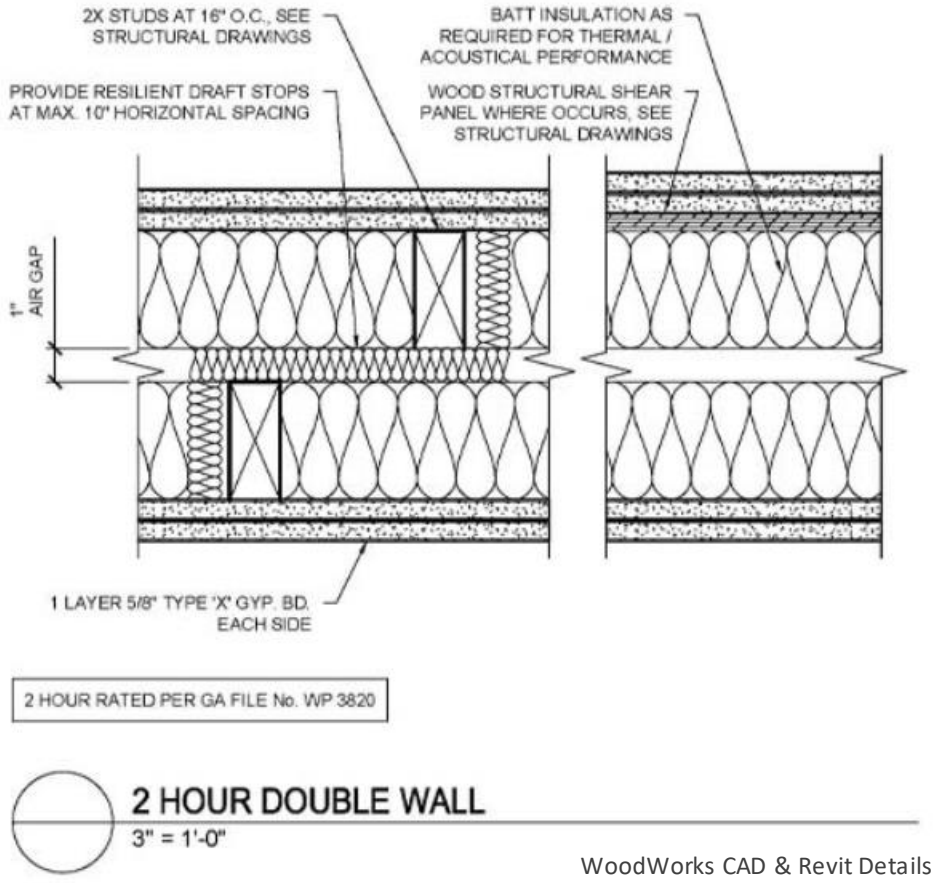
- Permitted in Type V construction
- Noncombustible materials required for Types III and IV construction
  - Opportunity for wood frame bearing walls on each side of fire wall to meet structural stability requirements



Credit: ClarkDietrich

Mixed Occupancy Buildings: Separate Buildings

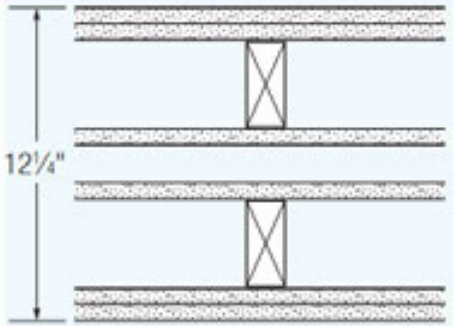
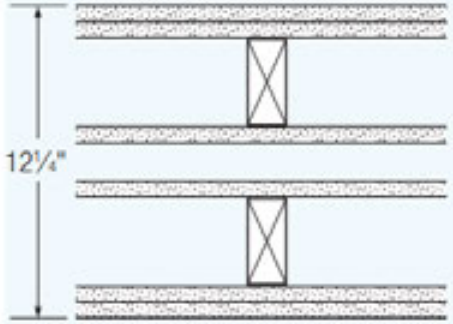
Type V construction, 2-hr fire wall assembly



WoodWorks CAD & Revit Details

Mixed Occupancy Buildings: Separate Buildings

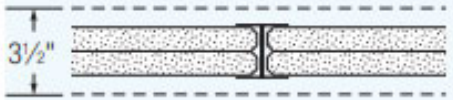
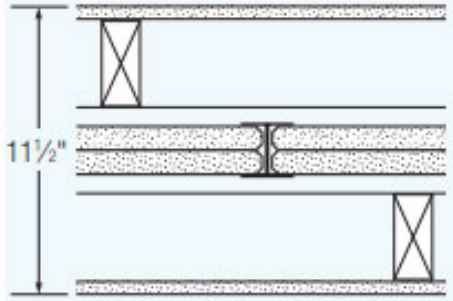
Type V construction, 2-hr fire wall assembly

Construction Detail	Description	Test Number	STC	Test Number
2 Hour Fire-Rated Construction				
	• 5/8" Sheetrock Firecode Core gypsum panels or Fiberock panels, outside • 5/8" Sheetrock Firecode Core gypsum panels or Fiberock panels – 2 x 4 wood studs 24" o.c.	**UL Des U342**		
	• Alternate based on 1/2" Sheetrock Firecode C Core gypsum panels, both outside, both walls double layer and inside single layer	**GA-WP-3810**	57	**RAL-TL-73-224** 3-1/2" glass fiber

USG Fire-Resistance Assemblies Catalog

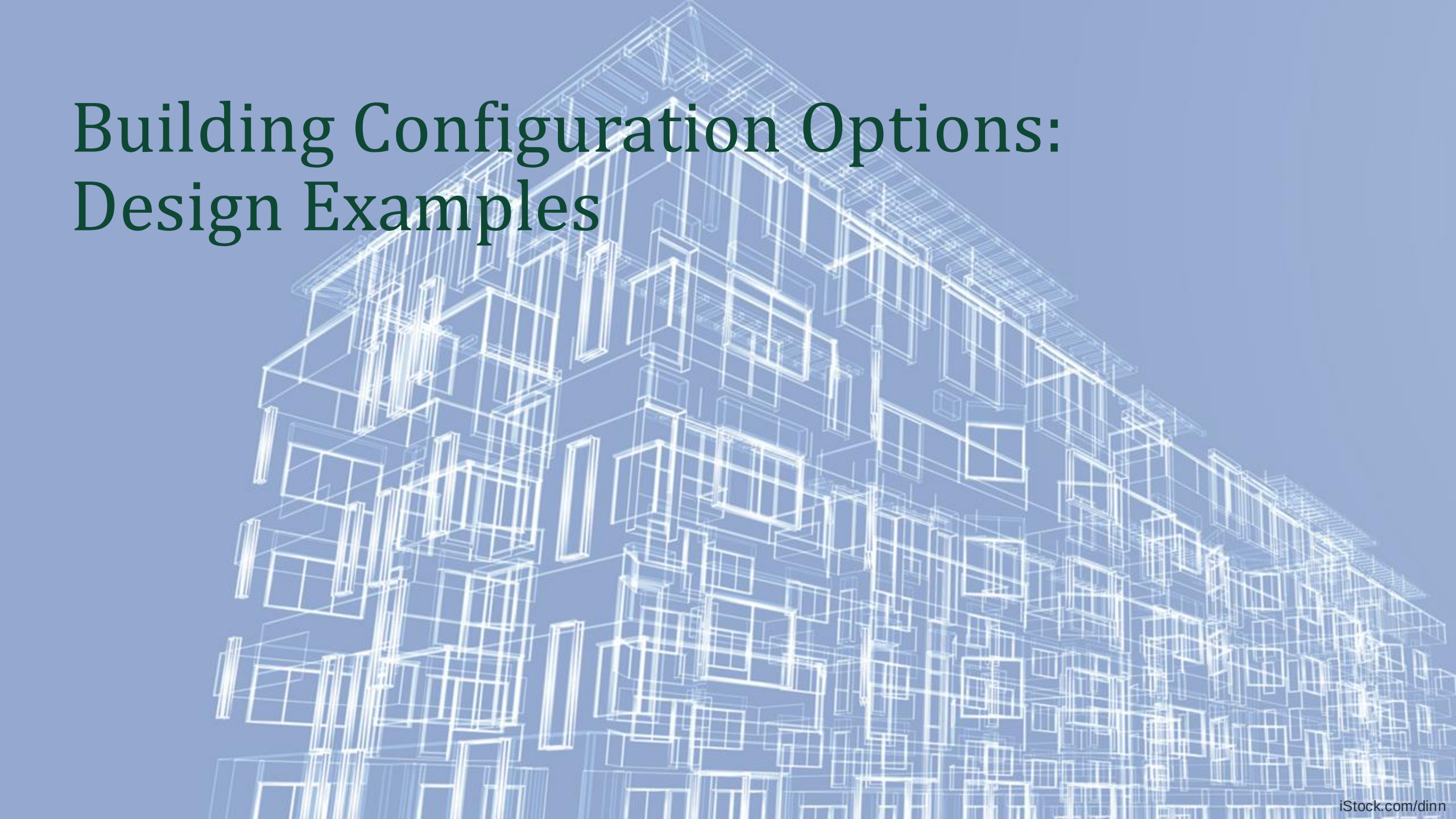
Mixed Occupancy Buildings: Separate Buildings

Types III, IV, V construction, 2-hr fire wall assembly

Construction Detail	Description	Test Number	STC	Test Number
2 Hour Fire-Rated Construction	**Area Separation Walls**			
	• 1" SHEETROCK gypsum liner panels • 2" USG H-Studs 24" o.c. – minimum 3/4" air space both sides separating liner panels from *adjacent construction*	**GA-ASW-1000**		
	Separation wall (non-loadbearing) • 1" SHEETROCK gypsum liner panels • 2" USG H-Studs 24" o.c. – Protected wall (bearing or non-loadbearing) of wood or steel studs each side min 3/4" from liner panels • 1/2" SHEETROCK gypsum panels **Note** These systems do not provide a fire rating for adjacent wood- or steel-framed walls.	**UL Des U336**	46	**RAL-TL-88-353**
			54	**RAL-TL-88-348** Based on 2" mineral wool batt on one side
			57	**RAL-TL-88-351** Based on 2 x 4s and 3" mineral wool batt on one side
			58	**RAL-TL-88-347** Based on 2 x 4s and 2" mineral wool batt on both sides
			60	**RAL-TL-88-350** Based on 2 x 4s and 3" mineral wool batt on both sides

USG Fire-Resistance Assemblies Catalog

Building Configuration Options: Design Examples



iStock.com/dinn

Building Configuration Options

- Multiple ways to classify a building
- For most cost-effective options: Challenge tradition and consider all options

iStock.com/SireAnko

Building Configuration Options

Mixed Use Occupancy Considerations:

- First floor often requires longer spans
  - Parking, retail, assembly
- Wood, steel, or concrete can be used for these longer spans
  - May not need Type I-A with podium
  - Types III or V (IBC 602)

Timber Lofts / Engberg Anderson Architects / Pierce Engineers / Photo Engberg Anderson Architects

Building Configuration Options:
Mixed Use Occupancy Options Example


Richardson Apartments / David + Baker Architects / photo Bruce Damonte

- 5-story building
  - 1st floor: Retail
  - 2nd – 5th floors: Residential

- Options:
  - 4-story Type V-A over 1-story Type I-A (podium provision, IBC 510.2)
  - 5-story Type III (A or B), separated occupancies
  - 5-story Type III-B with firewalls(s), separated occupancies

Building Configuration Options:
Mixed Use Occupancy Options Example


Washington Place / Joseph Tatone & Associates / photo Gregory Folkins

- 5-story building
  - 1st floor: Parking
  - 2nd – 5th floors: Residential

- Options:
  - 4-story Type V-A over 1-story Type I-A (podium provision, IBC 510.2)
  - 4-story Type V-A over 1-story Type IV (open) or Type I (no podium, IBC 510.4)
  - 5-story Type III (enclosed parking), separated or nonseparatedoccupancies

Building Configuration Options:
Mixed Use Occupancy Options Example


Barracuda Condos – Madison WI /
Populance Architecture and Development

- 7-story building (6 above grade)
  - Basement: Parking
  - 1st – 6th floors: Residential

- Options:
  - 5-story Type III over 1-story Type I-A (podium provision, IBC 510.2)
  - 4-story Type V-A over 2-story Type I-A (podium provision, IBC 510.2)
  - 6-story Type III (limitations per IBC 510.5 – 3,000 sf max FRR areas and other)

Building Configuration Options:
Mixed Use Occupancy Options Example

- 4-story building
  - 1st floor: Parking
  - 2nd – 4th floors: Residential

- Options:
  - 3-story Type V-B over 1-story Type I-A (podium provision, IBC 510.2)
  - 3-story Type V-B over 1-story Type IV (open) or Type I (no podium, IBC 510.4)
  - 4-story Type V-A (enclosed parking), separated or nonseparated occupancies

Building Configuration Options:
Mixed Use Occupancy Options Example


Aloft Dallas Arlington TX Entertainment District / JRK Design / Gregory Folkins

- 5-story building (hotel)
  - 1st floor: Lobby, restaurant, fitness center, conference rooms, residential
  - 2nd – 5th floors: Residential
- Options:
  - 4-story Type V-A over 1-story Type I-A (podium provision, IBC 510.2)
    - 1st floor: separated or nonseparated occupancies considering just 1st floor
  - 5-story Type III (firewalls if needed)
    - 1st floor: separated or nonseparated occupancies considering all floors

Building Configuration Options:
Mixed Use Occupancy Options Example

Hyatt Place Hotel – Greensboro NC / R4 Architecture / photo Greg Folkins

- T- and L-shared buildings
  - Common in hotels
  - Often large floor areas

Building Configuration Options:
Mixed Use Occupancy Options Example

Hyatt Place Hotel – Greensboro NC / R4 Architecture / photo Greg Folkins

- T- and L-shared buildings
  - May work well with firewalls at building intersections
  - Minimize length and impact of firewall
  - Maximize allowable building area
  - May allow lower construction type (i.e., III-B instead of III-A)

Questions? Ask us anything.

Shannon A. Williams, PE
Regional Director – NJ, PA
(267) 378-5345

shannon.williams@woodworks.org

901 East Sixth, Thoughtbarn-Delineate Studio, Leap!Structures, photo Casey Dunn

Copyright Materials

Funding provided in part by the Softwood Lumber Board