AIA CONFERENCE
ON ARCHITECTURE & DESIGN

WoodWorks Learning Lounge

Presented by WoodWorks
June 11 and 12, 2026

The Soto, Hixon Properties, Lake|Flato, BOKA Powell, StructureCraft, Photo Erika Brown Edward

Regional Directors: **One-on-One Project Support**

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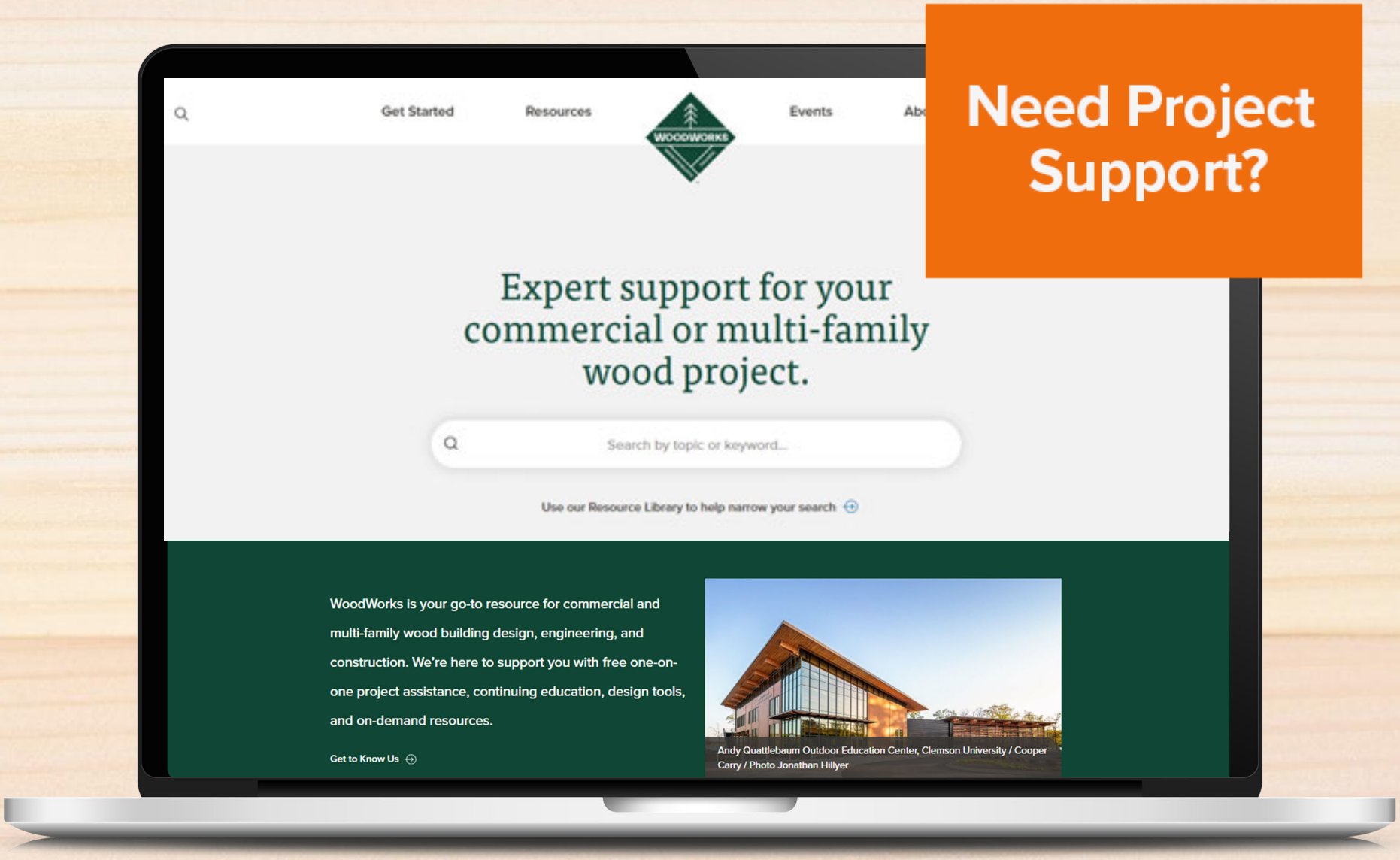

BUILDING SYSTEMS

- Mass Timber / CLT
- Light-Frame
- Hybrid
- Off-Site / Panelized Construction

BUILDING TYPES

- Multi-Family / Mixed Use
- Education
- Institutional / Healthcare
- Civic / Recreational
- Industrial
- Office
- Commercial Low-Rise

WHY WOOD?

- Sustainability
- Forests, Wildfire & Rural Communities
- Evolving Codes
- Cost Effectiveness

Get help penciling it out. **Free Project Support**

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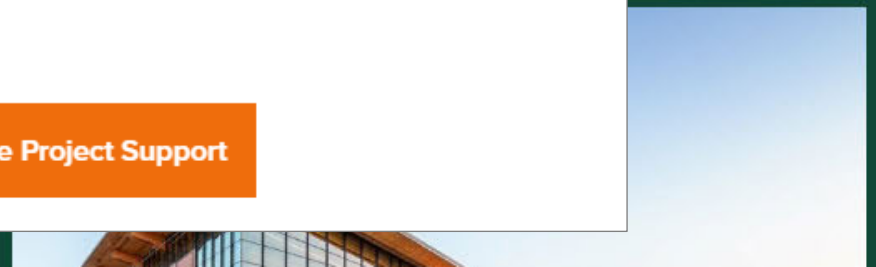


modular

Building Systems

- Light-Frame 8
- Hybrid 7
- Panelized Construction 4
- Mass Timber / CLT 2

Building Types

- Multi-Family / Mixed-Use 9
- Education 2
- Office 2
- Civic / Recreational 1
- Commercial Low-Rise 1
- Industrial 1
- Institutional / Healthcare 1

Project Roles

- Architect 8
- Structural Engineer 8
- Contractor/Installer 7
- Developer/Owner 7

Resource Types

Modular Mass Timber from Design to Delivery

October 8, 2025 - National Online Seminar. This course will explore the use of mass timber modular construction in multi-family and mixed-use building types and showcase the recently completed Knight Building in Big Sky, MT—the first large-scale modular mass timber building in the U.S.

Online Events

The Modular Enclosure: Protect Your Investment During Every Phase

How traditional building enclosure design considerations translate to modular projects

Expert Tips

The Modular Design Process – Design of the Units

Considerations for the design of modular, multi-family projects, including pre-design essentials, construction type, elements of unit design, and modular vs. traditional layouts

Expert Tips

Assessing the Financial Feasibility of Modular Construction

Considerations for developers and building designers evaluating the potential cost benefits of modular for a multi-family project

Expert Tips

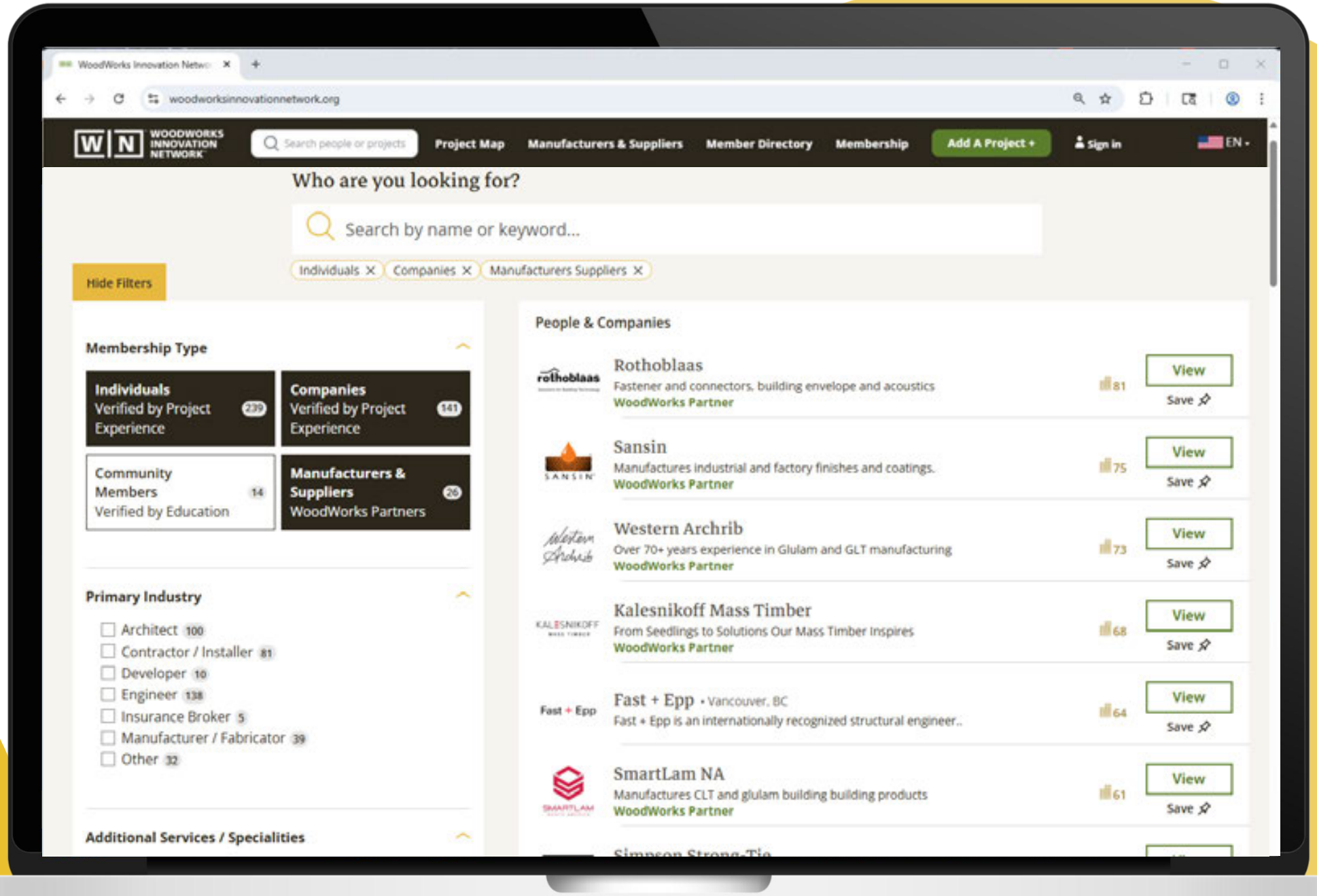
Roles and Responsibilities: Structural Design of Modular Projects

An overview of structural engineering roles for modular

Regulating Off-Site Construction: Ensuring Code Compliance in a Factory-Built Environment

Understanding the process of building code compliance for

WOODWORKS INNOVATION NETWORK™



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Wellesley College Science Complex / Skidmore, Owings & Merrill / Le Messurier / Photo Dave Burk © SOM

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

Taking the Guesswork out of Mixed-Use Building Analysis

Jason Bahr, PE & Michael Muller, PE, SE
WoodWorks

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

AIA Approved Continuing Education

Course Description

While mixed-use buildings—which combine multiple occupancy types and/or functions in a single structure—are common, determining how to apply their unique mix of code requirements can be a daunting task. To simplify code analysis associated with these buildings, this presentation covers logical, code-compliant steps for a number of topics, including determining allowable building size, separation needs, detailing requirements, and the application of special provisions. With an emphasis on the use of wood framing in Construction Types III, IV and V, examples, calculations, and details will be presented to demonstrate how to navigate the various code requirements associated with mixed-use buildings while maximizing building size and meeting fire and life safety needs.

Learning Objectives

1. Review the basic fire and life safety requirements associated with mixed-use, wood-frame structures.
2. Become familiar with the differences between Construction Types III, IV and V as defined by the International Building Code.
3. Highlight options for determining allowable building size of mixed-use facilities, including separated and non-separated occupancies, incidental uses and podiums.
4. Demonstrate how to achieve separation of occupancies with fire barriers, fire walls and horizontal assemblies.

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

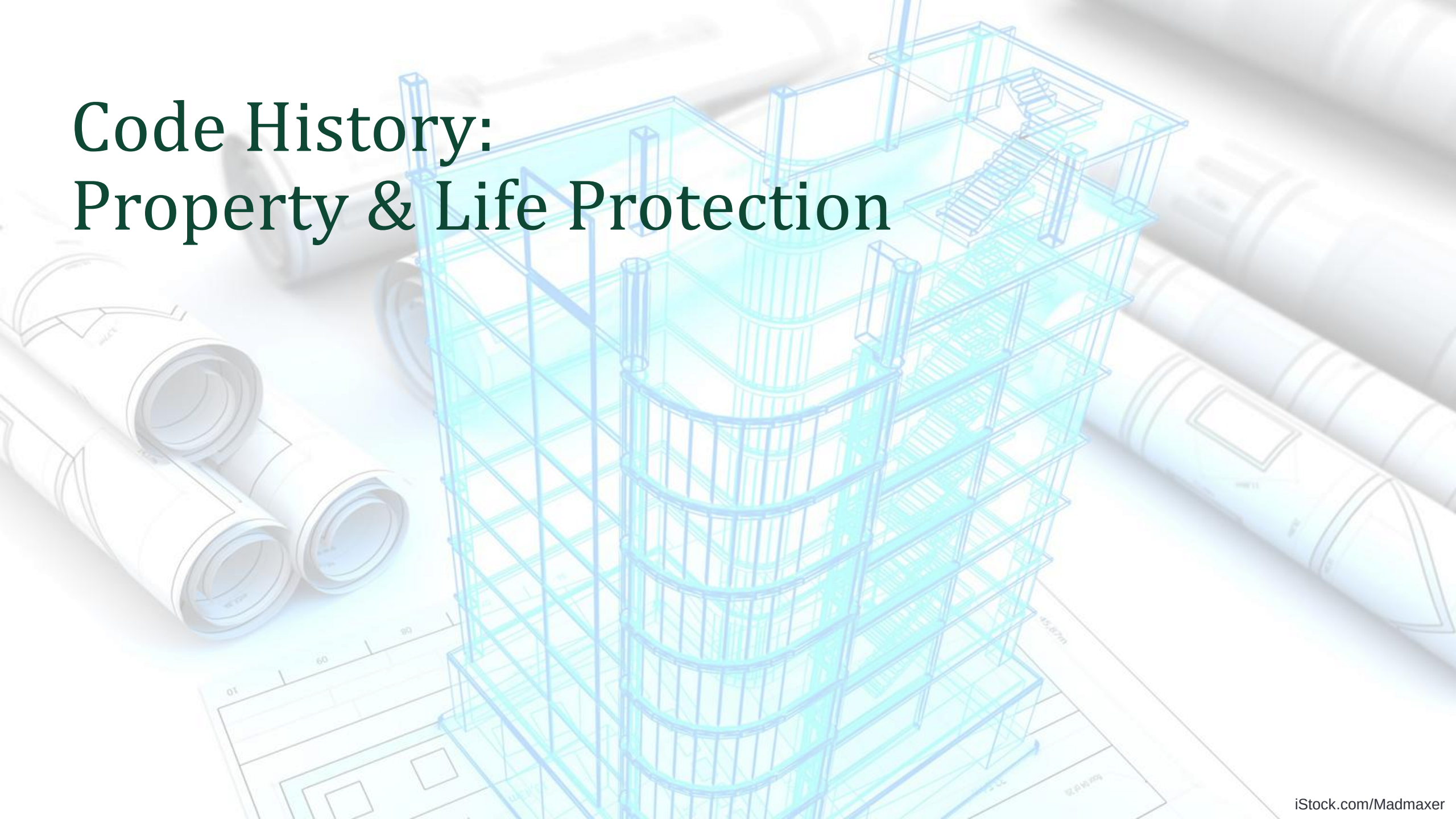
Stella / DesignARC / Taylor and Syfan /
Photo Lawrence Anderson/Esto

Agenda

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

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

Code History:
Property & Life Protection



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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

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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

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Fire and Life Safety in the Code

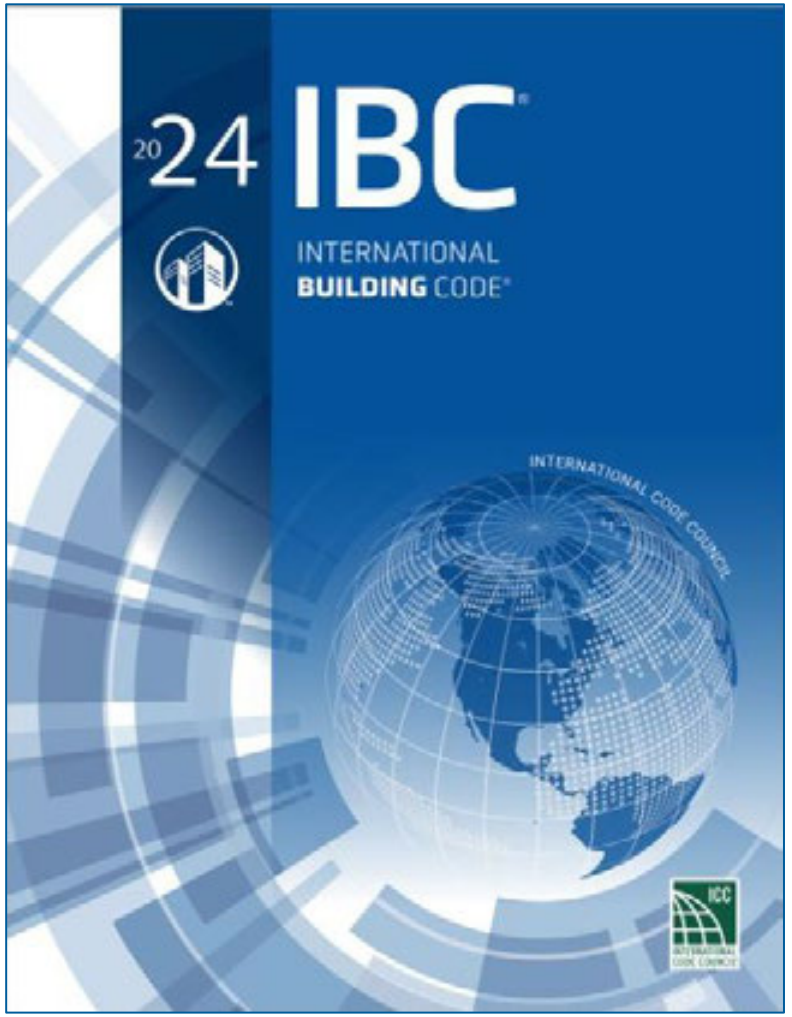
Modern building codes:

- 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

Current building codes:

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

Fire and Life Safety in the Code

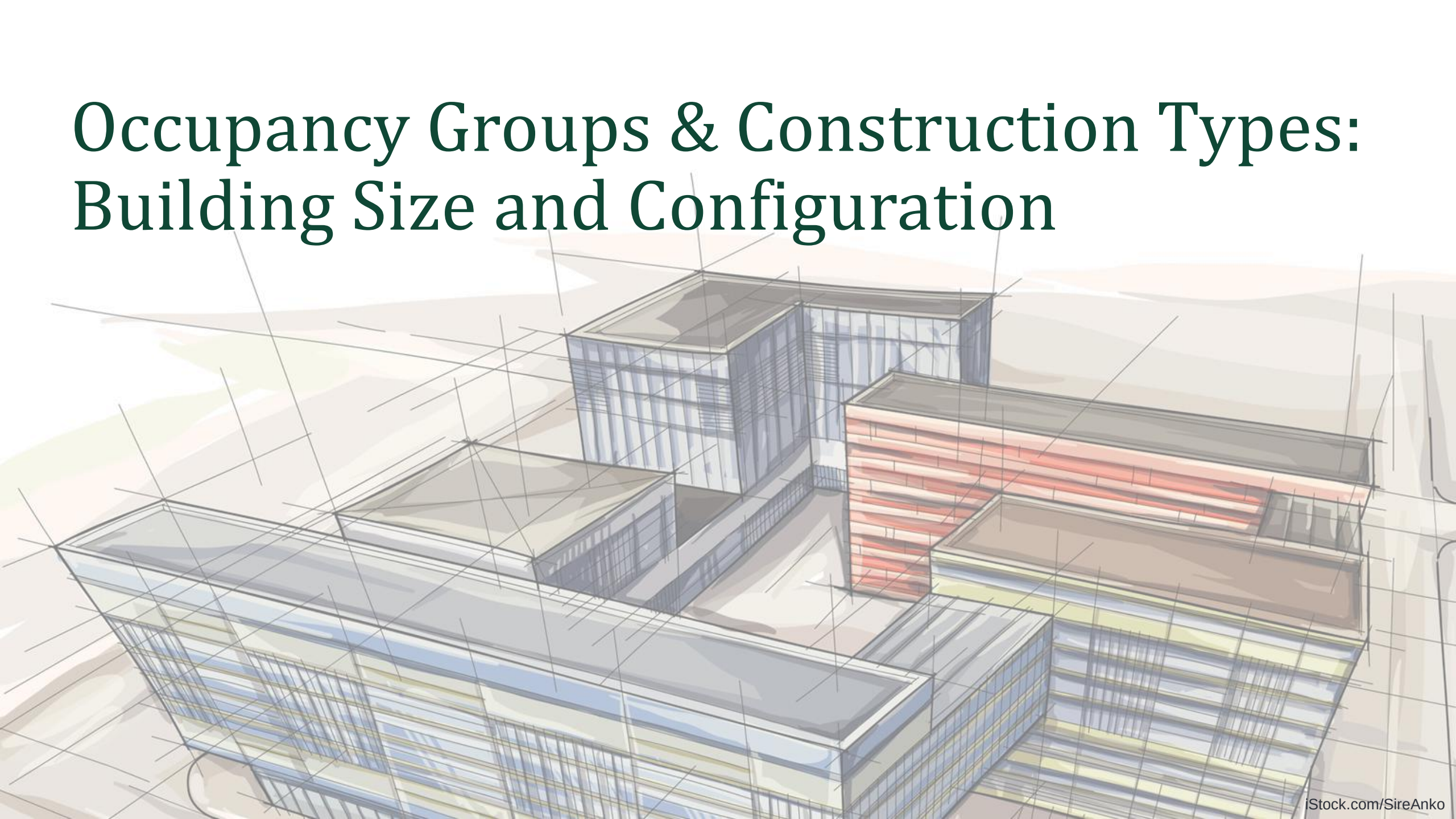
Current building codes:

- 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



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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

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

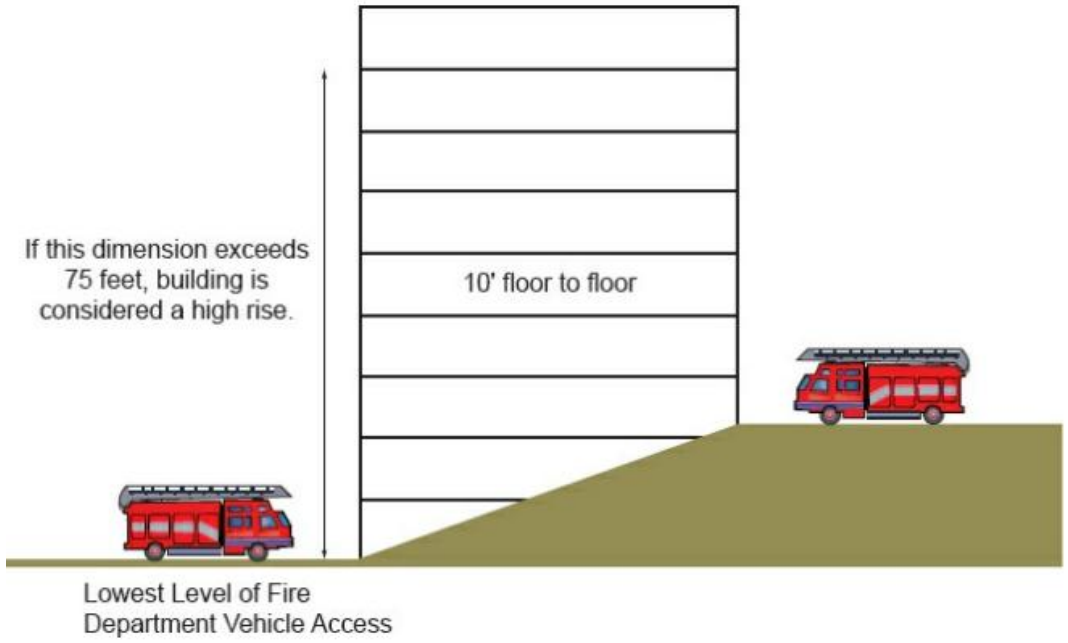
Allowable Building Size

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.

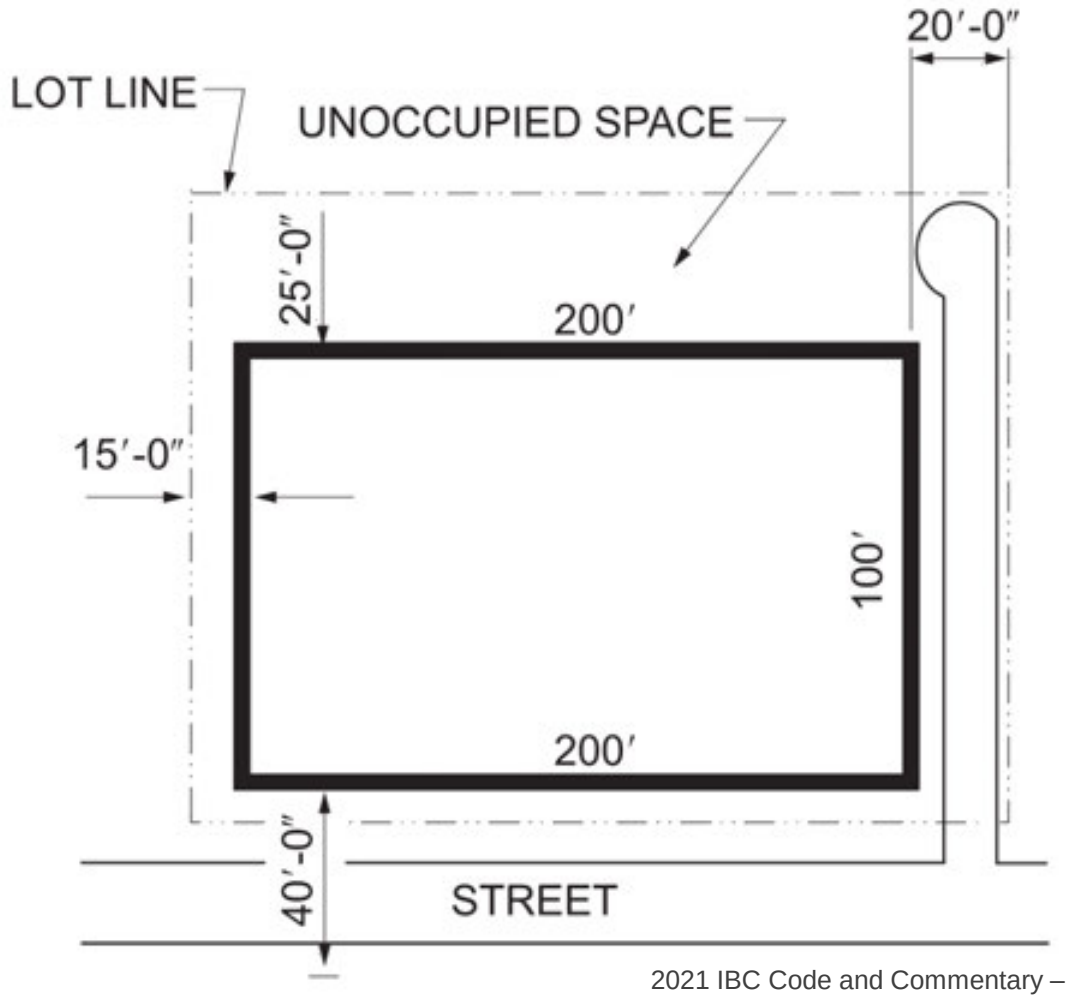


Building Code Essentials: Based on the 2021 International Building Code, Steve Thomas, CBO, Figure 6-7

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

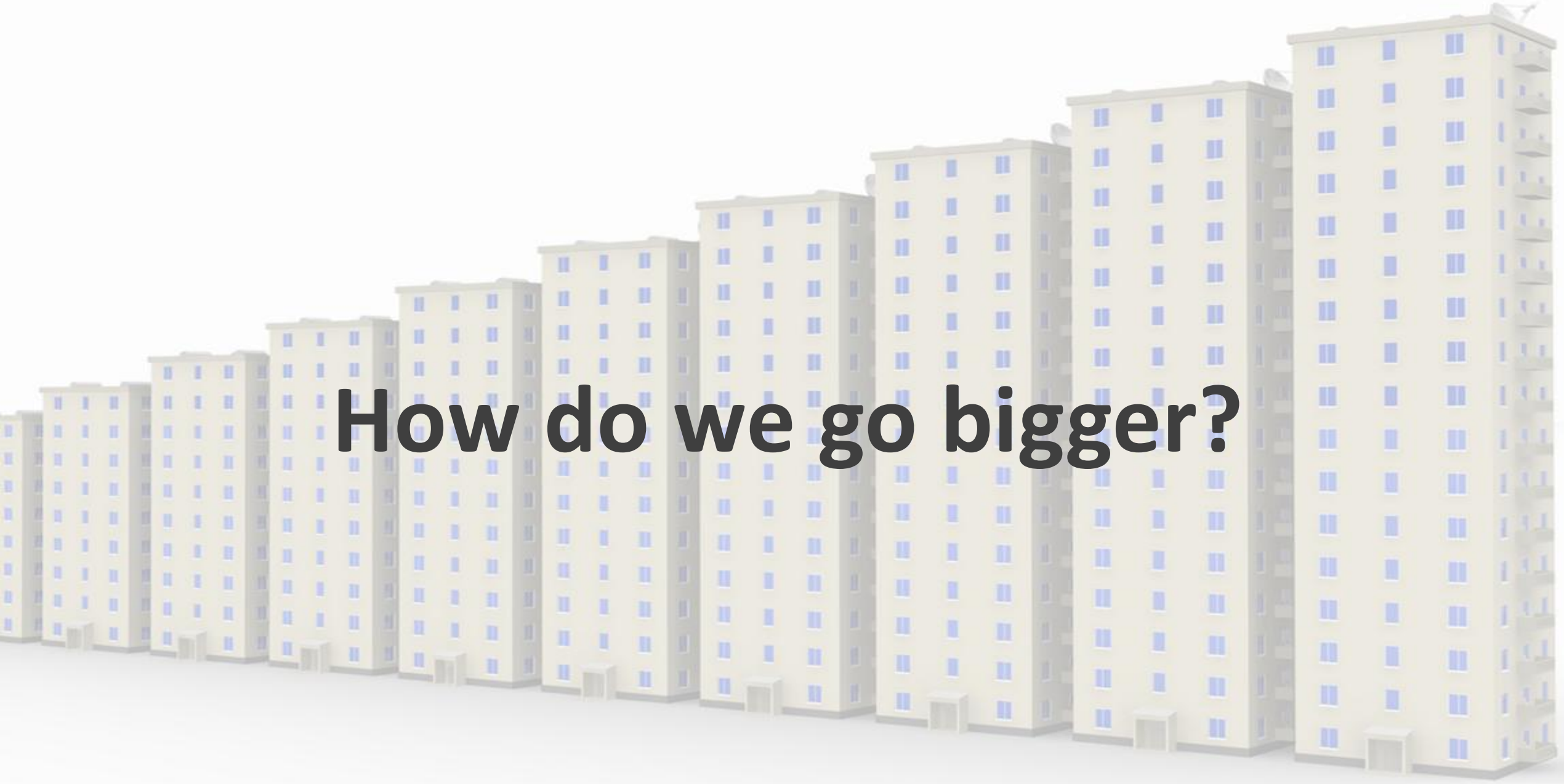
Allowable Story **Area** (IBC 2021 Table 506.2)

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?



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Allowable Building Size

Allowable size increases:

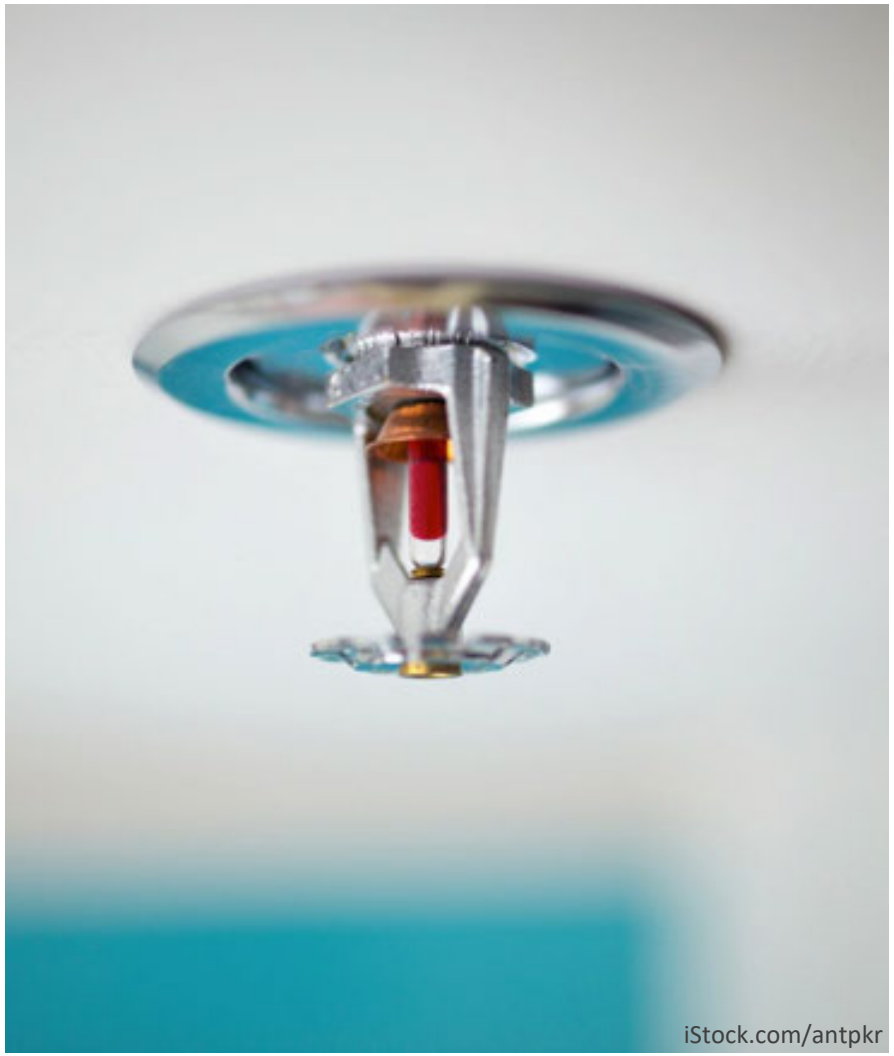
- Height / Number of stories
- Area per floor

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: 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]

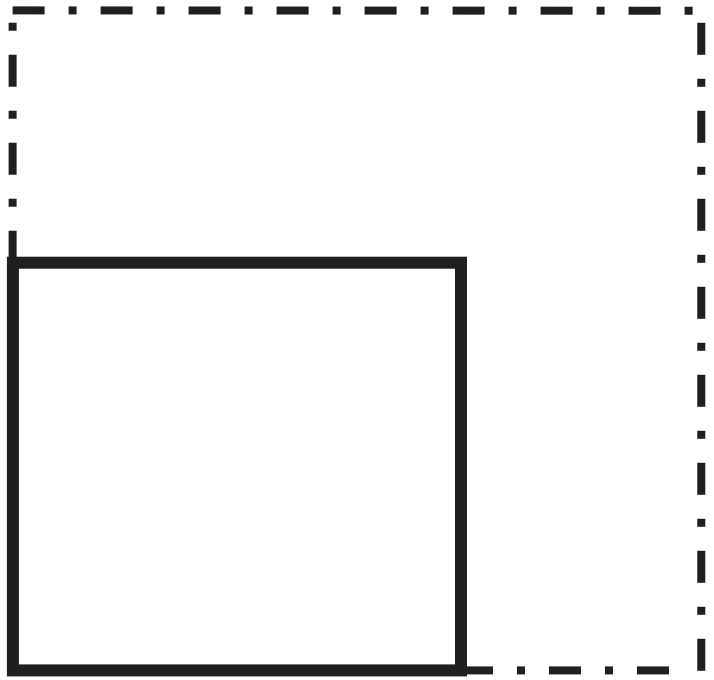
OCCUPANCY CLASSIFICATION	See Footnotes	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	18	12	9	6	4	3
R-1[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	18	12	8	5	4	3
R-2[h]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

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

Allowable Building Size

Allowable building area

- IBC 506.2.1

- 1-story buildings:
  - Total area = Area per floor x 1
- 2-story buildings:
  - Total area = Area per floor x 2
- 3-story or more buildings:
  - Total area = Area per floor x 3

Riverview Hall – Sacramento CA / Solomon Cordwell Buenz / Christian Cortes

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?

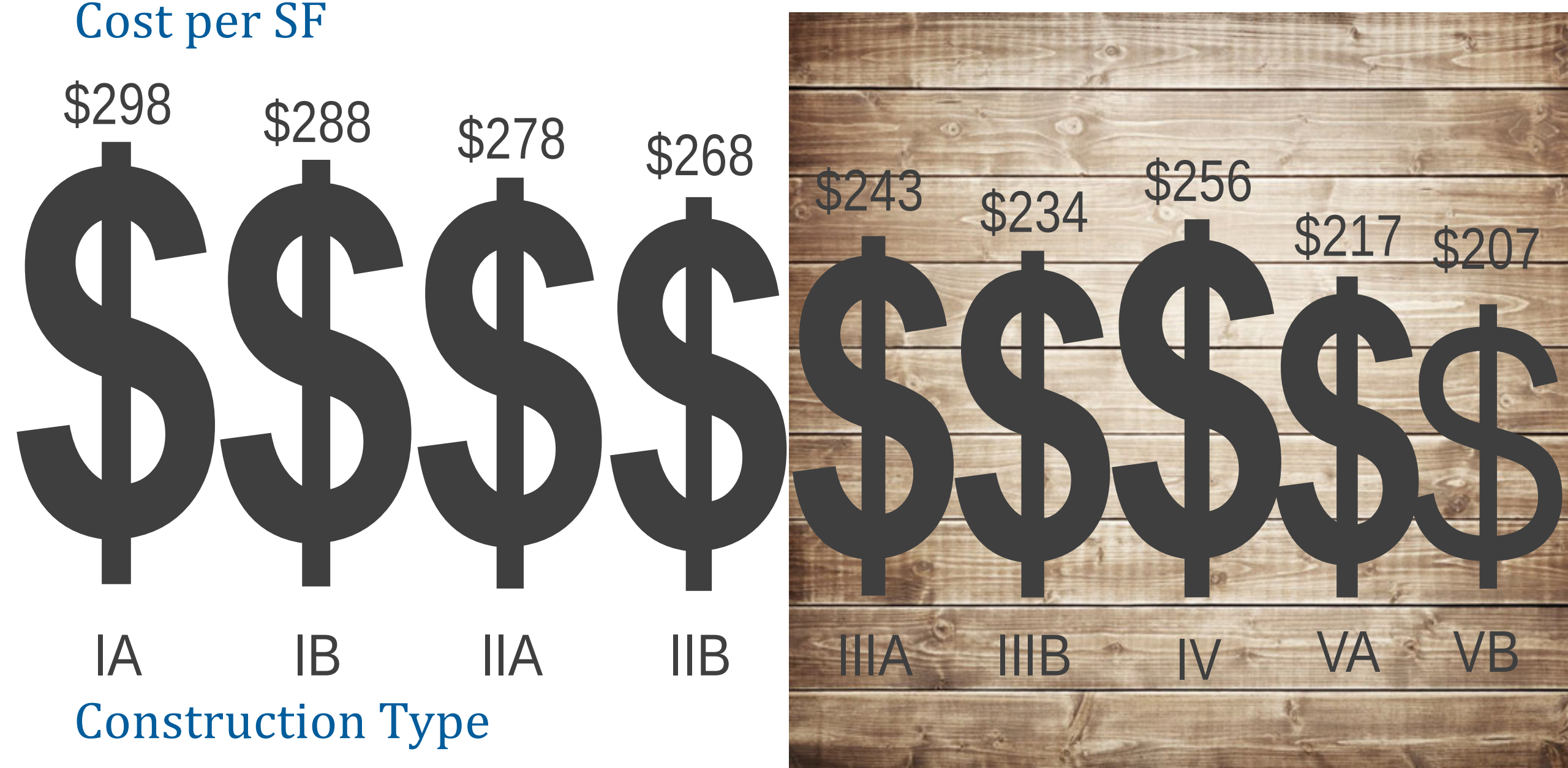
- Low- to mid-rise buildings
  - Often default to Type II construction
  - Nearly identical building sizes for Type III
  - Many commercial / multi-family projects can be Type V

Wood framing can be used for Types III and V!

iStock.com/Andranik Hakobyan

ICC Building Valuation Data, **B occupancy**, February 2025

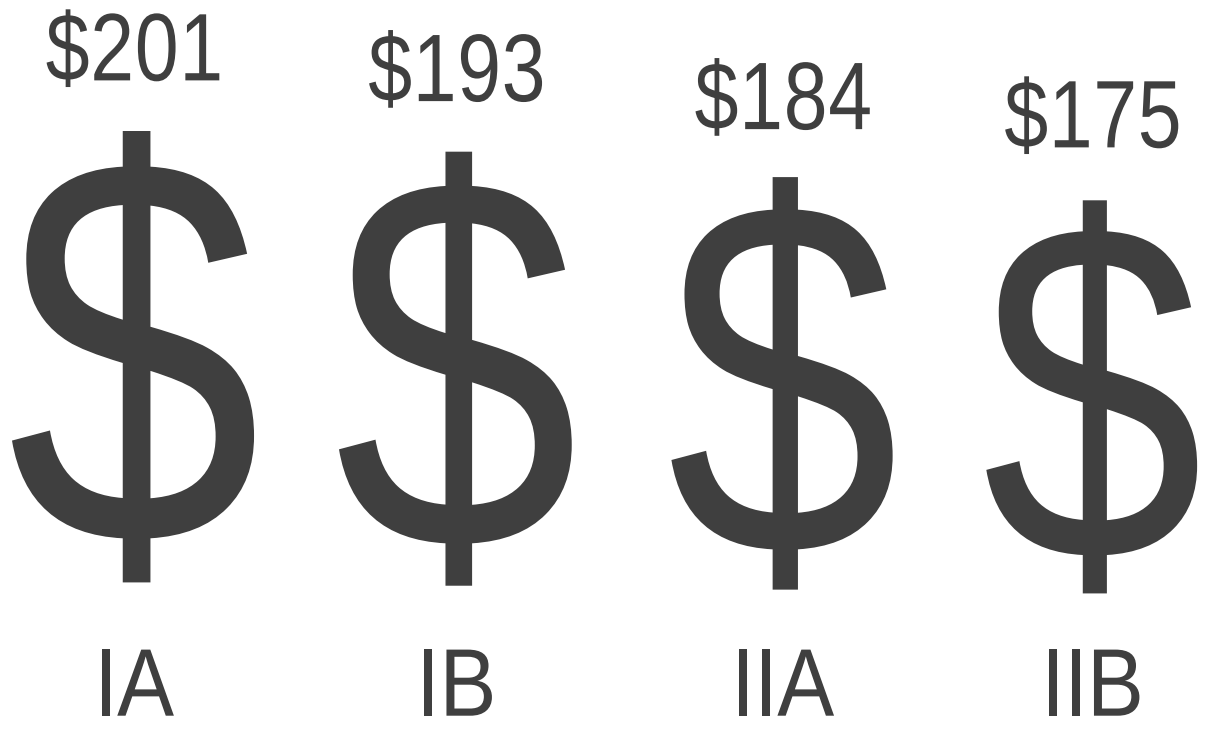
Cost per SF



Construction Type

ICC Building Valuation Data, **M occupancies**, February 2025

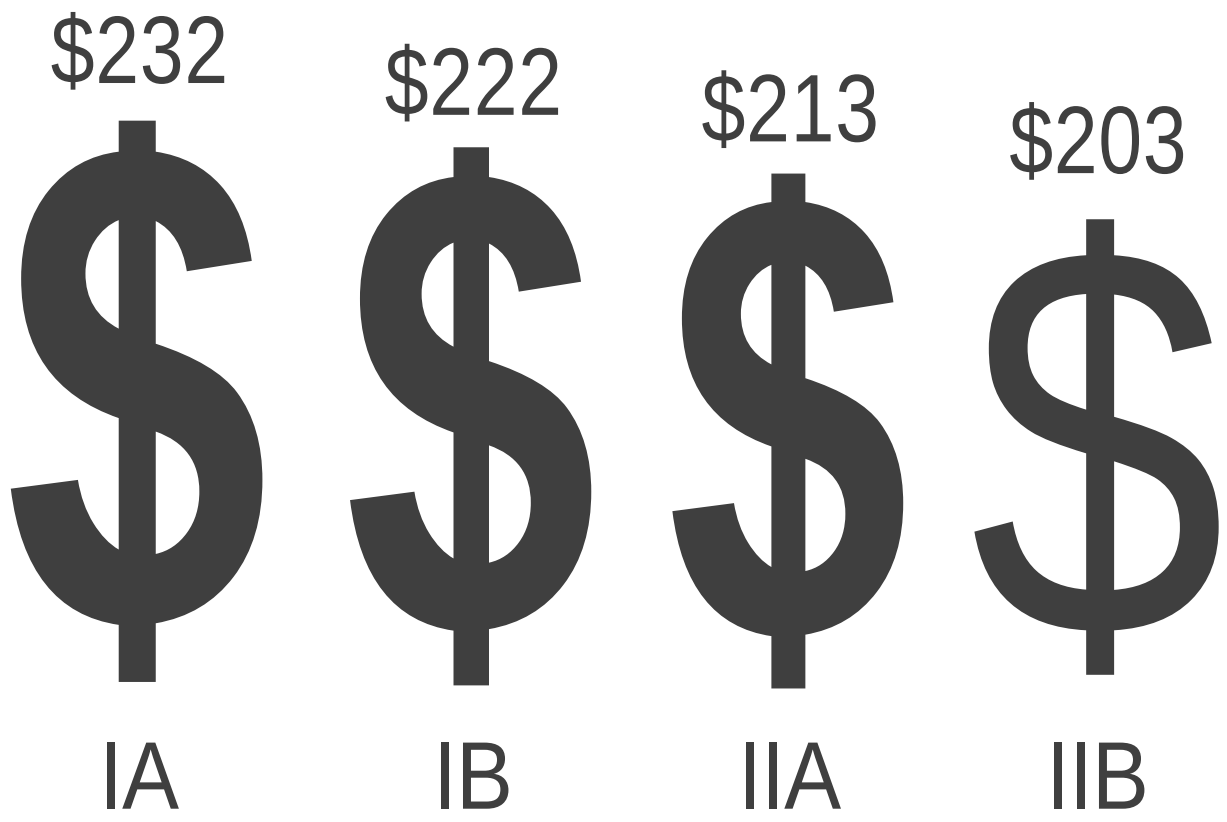
Cost per SF



Construction Type

ICC Building Valuation Data, **R-2 occupancies**, February 2025

Cost per SF



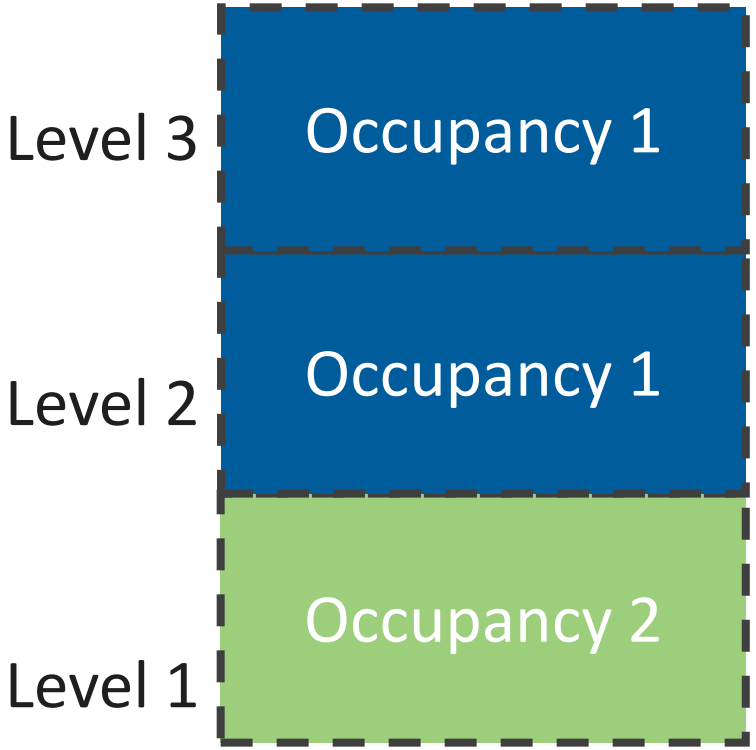
Construction Type

Mixed Use Buildings: Mixing Occupancies

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

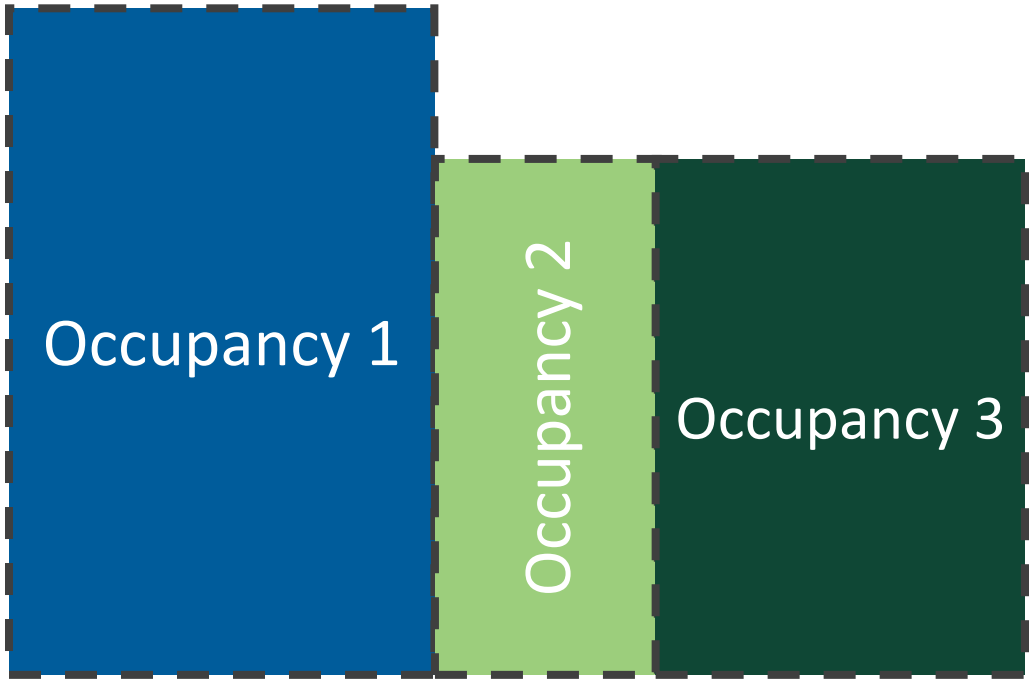
Mixed Occupancy Buildings

» Different occupancies on **different** levels:



Elevation view

» Different occupancies on **same** level:



Plan View

Mixed Occupancy Buildings: Special Provisions and Design Allowances

Broadstone Apartments on 5th – Fort Worth / 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

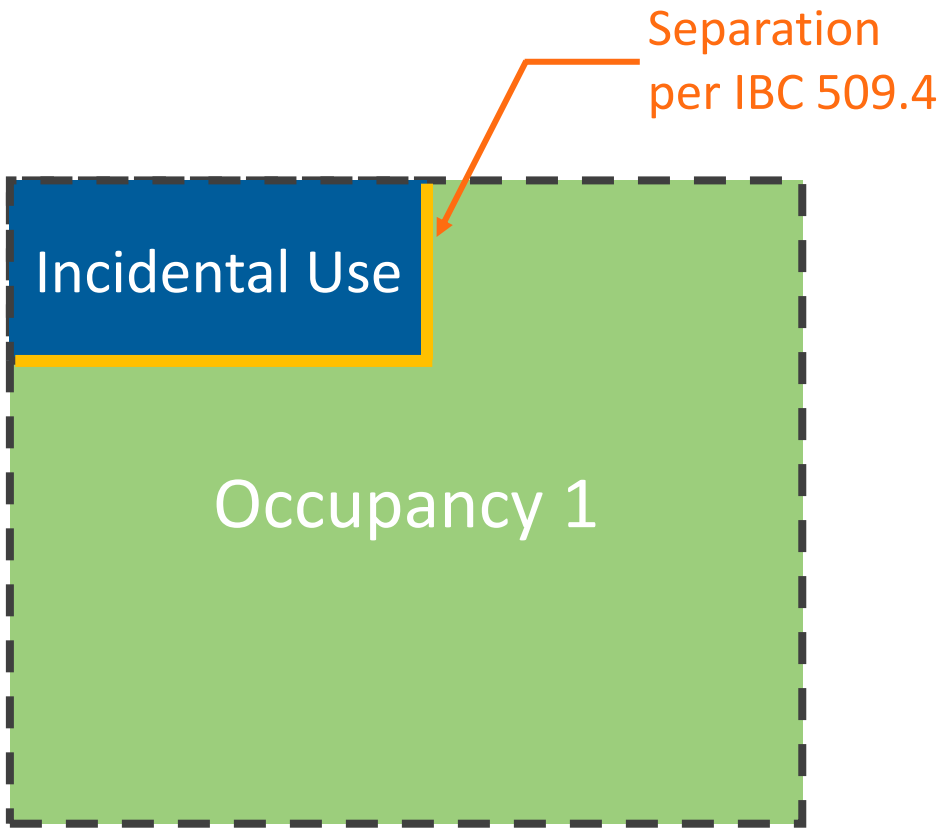
Mixed Occupancy Buildings: Incidental Uses

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: Accessory Occupancies

Accessory Occupancies (IBC 508.2)

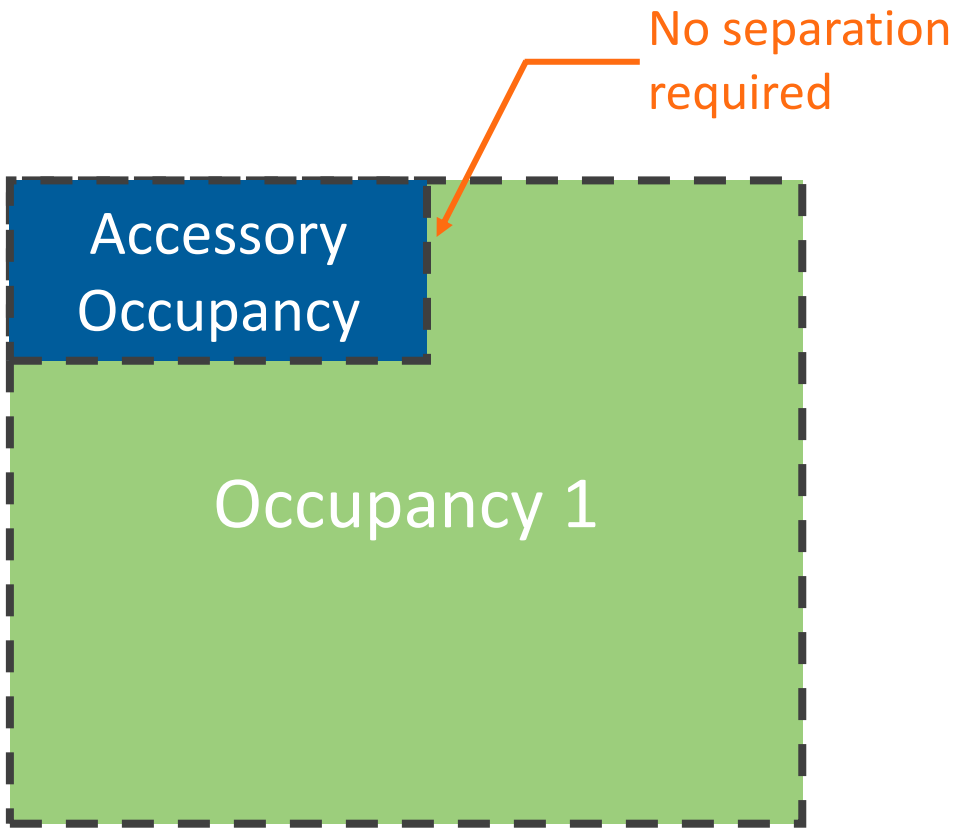
- Ancillary to the main occupancy

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:

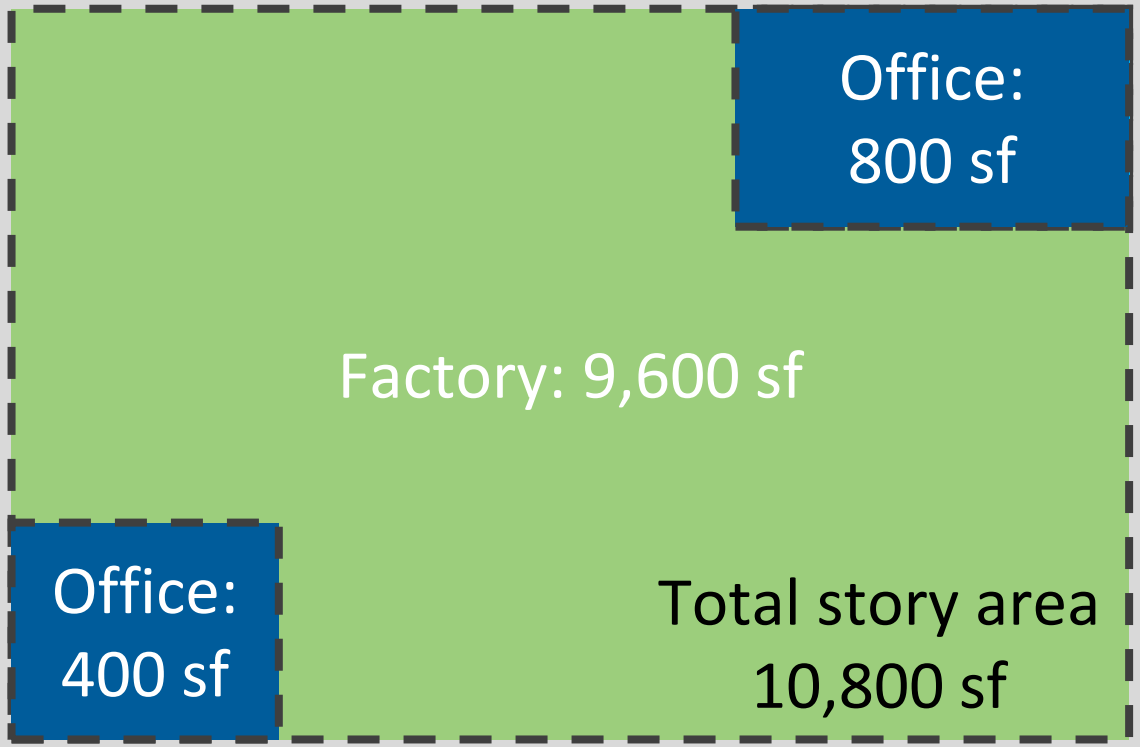
- No separation between occupancies*
- Allowable building area and height per main occupancy



* Separation required for hazardous occupancies and residential separations

Mixed Occupancy Buildings: Accessory Occupancies

Example: Accessory Occupancies



- 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: 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

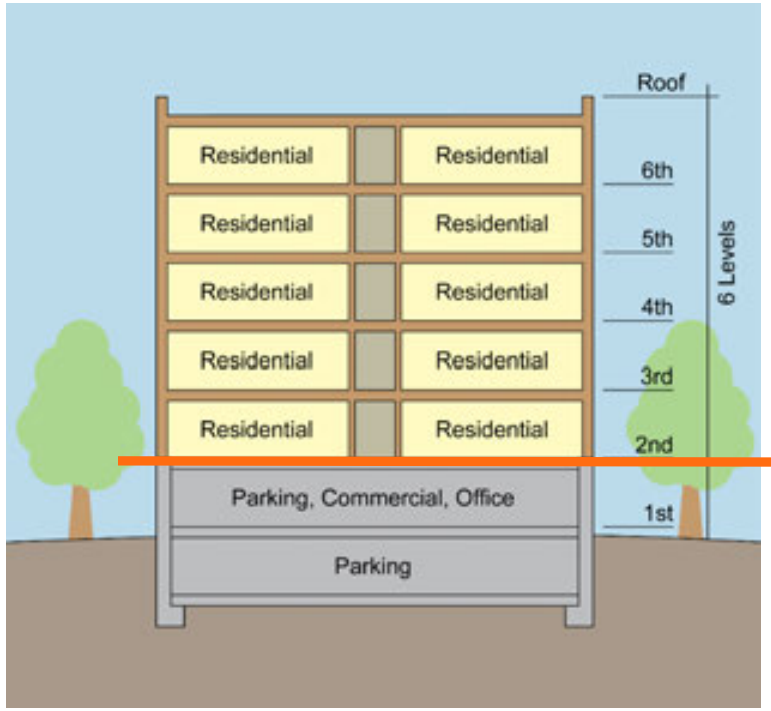
Horizontal Building Separation **(Podium Provision)** (IBC 510.2)

- 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)



3-hr

Type I-A

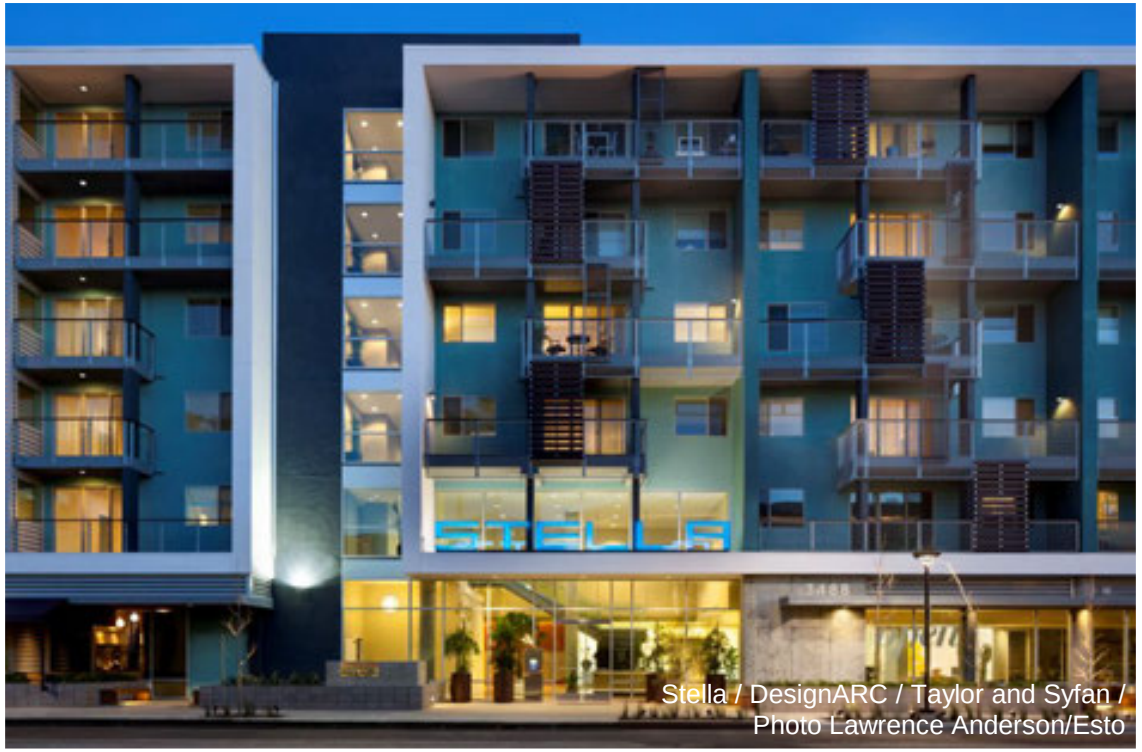
IBC	2006	2009	2012	2015	2018	2021
Section	509.2	509.2	510.2	510.2	510.2	510.2
Upper Occupancy	A, B, M, R or S					
Lower Occupancy	S-2 Parking	A, B, M, R or S-2 Parking		Any Except H		
Podium Height	1 Story			No Restriction		

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:

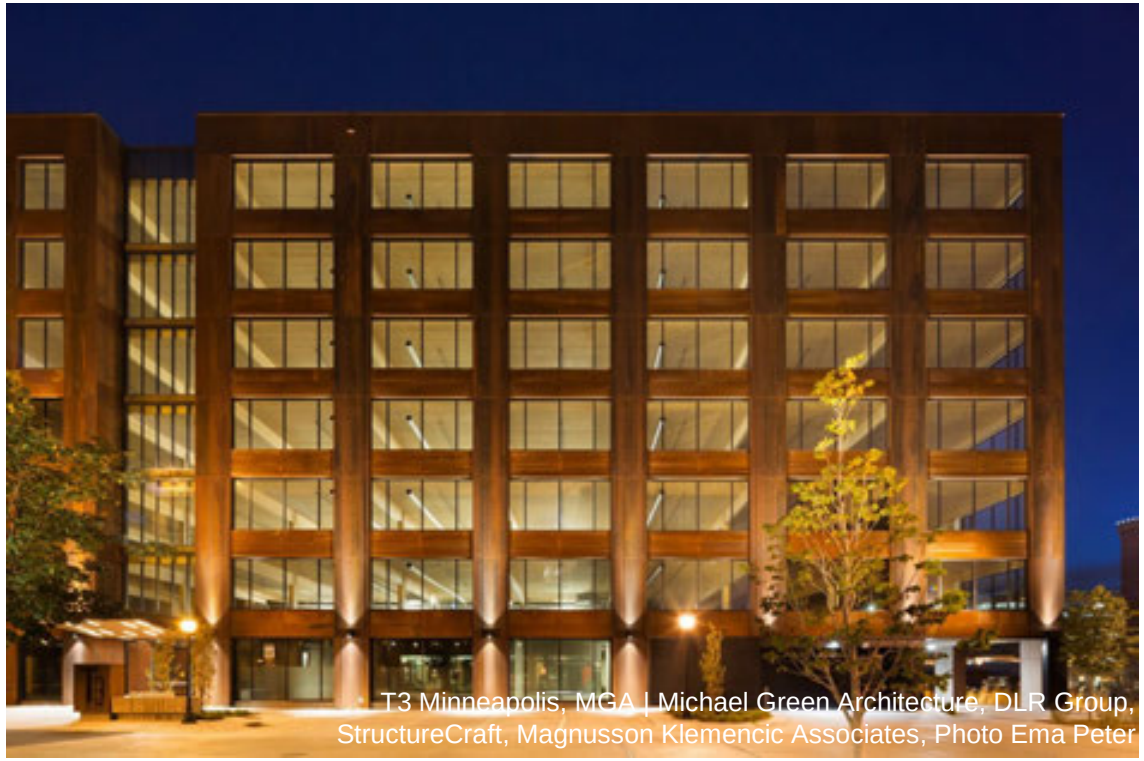
Marselle Condominiums / PB Architects / Yu & Trochalakis / Matt Todd Photography

Mixed Occupancy Buildings: Special Provisions

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

7 stories office:

6-story Type III or IV over 1-story podium:



T3 Minneapolis, MGA | Michael Green Architecture, DLR Group, StructureCraft, Magnusson Klemencic Associates, Photo Ema Peter

Mixed Occupancy Buildings: Special Provisions

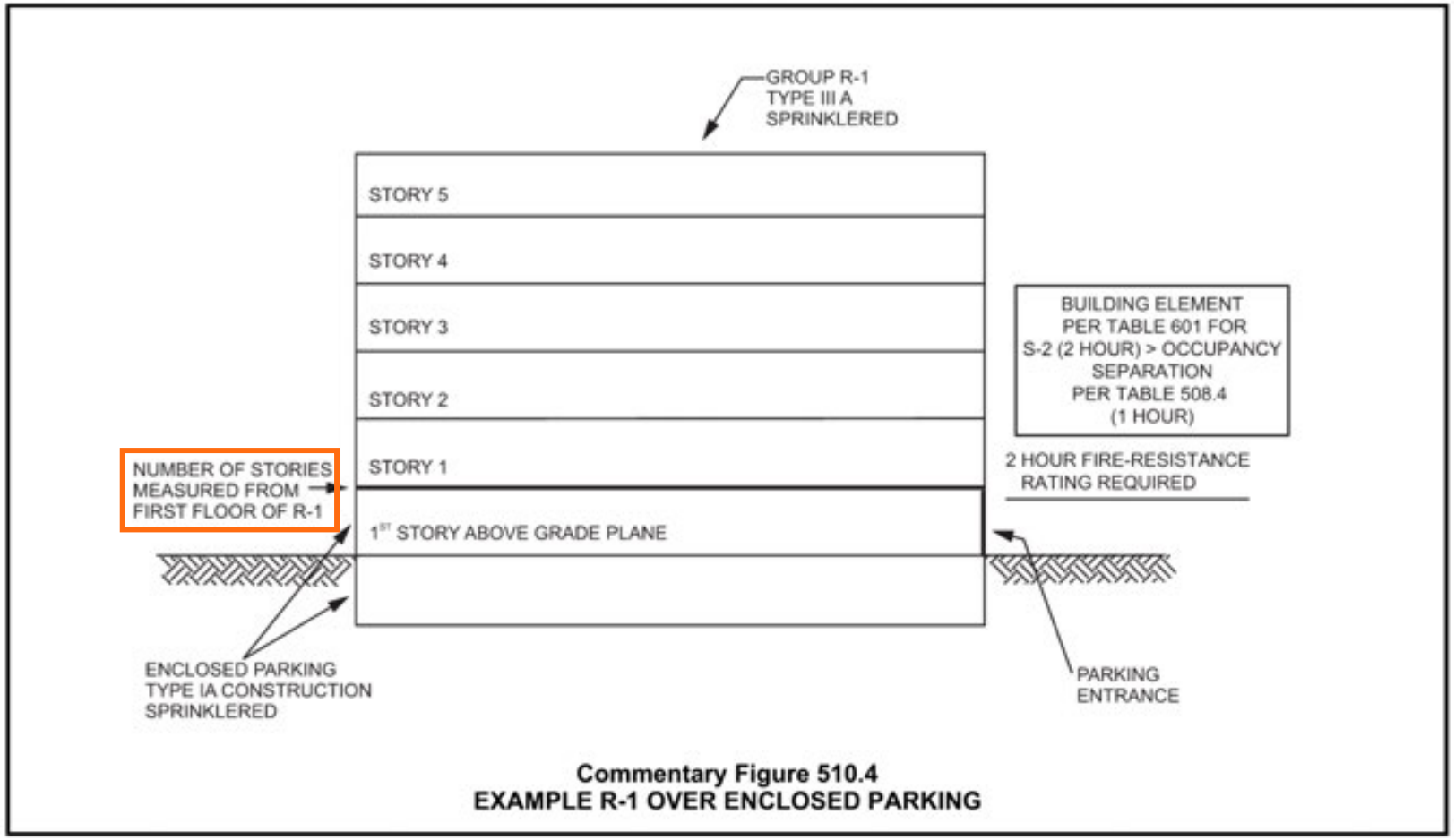
Parking beneath Group R (IBC 510.4)

- 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

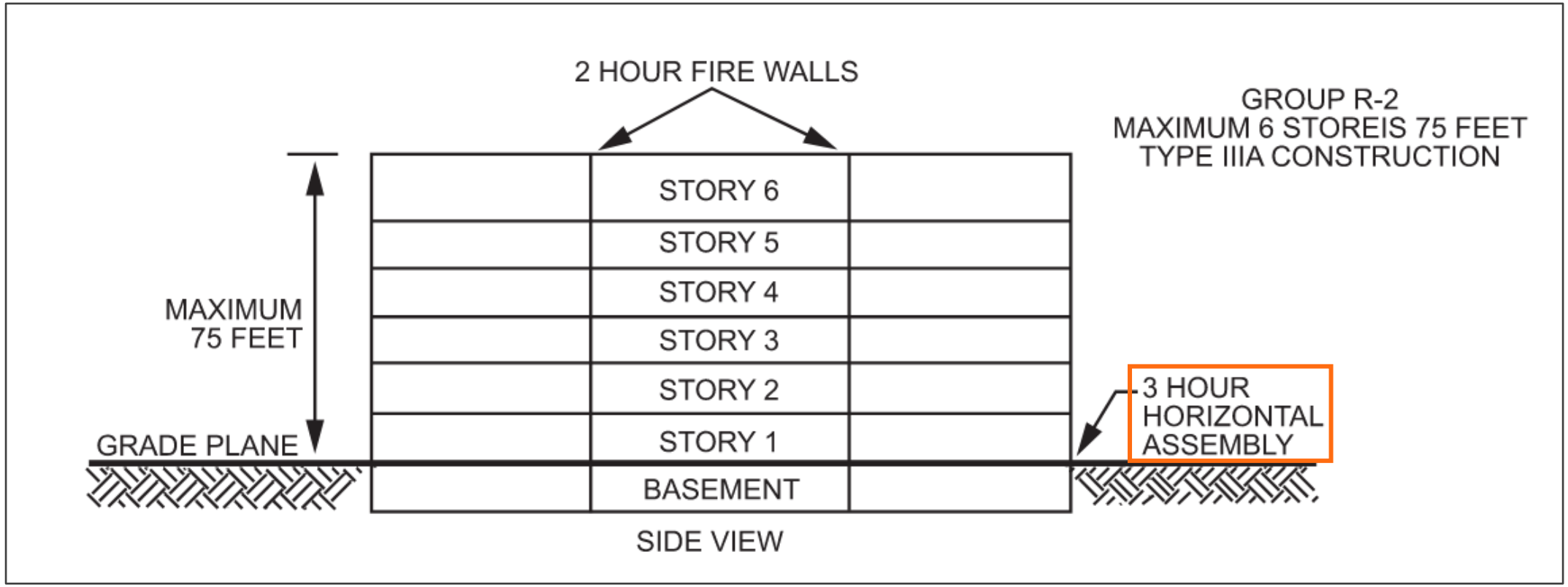
Group R-1 / R-2, Type III-A buildings height / story increase (IBC 510.5)

- 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: Special Provisions

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



2021 IBC Code and Commentary –
Volume 1, Commentary Figure 510.5

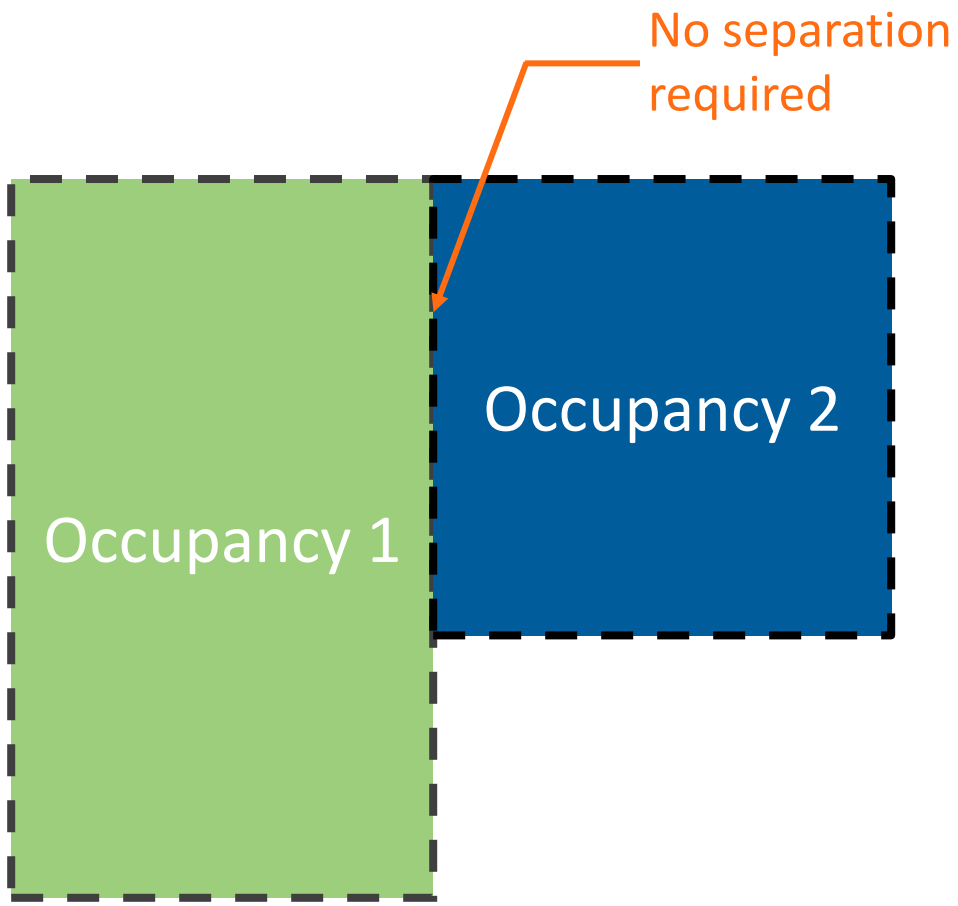
Mixed Occupancy Buildings: Nonseparated Occupancies

Washington Place / Joseph Tatone & Associates / Gregory Folkins

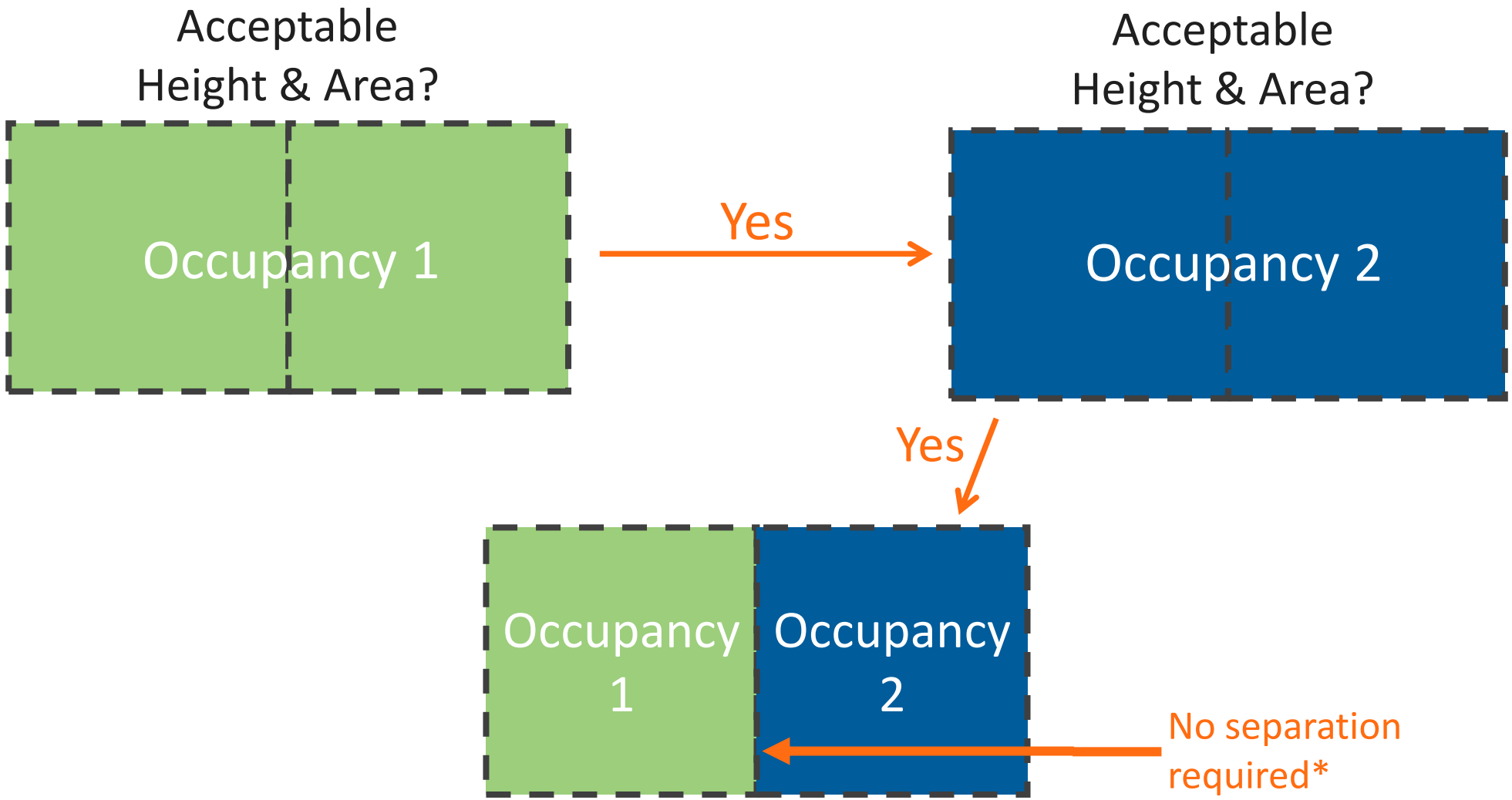
Mixed Occupancy Buildings: Nonseparated Occupancies

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

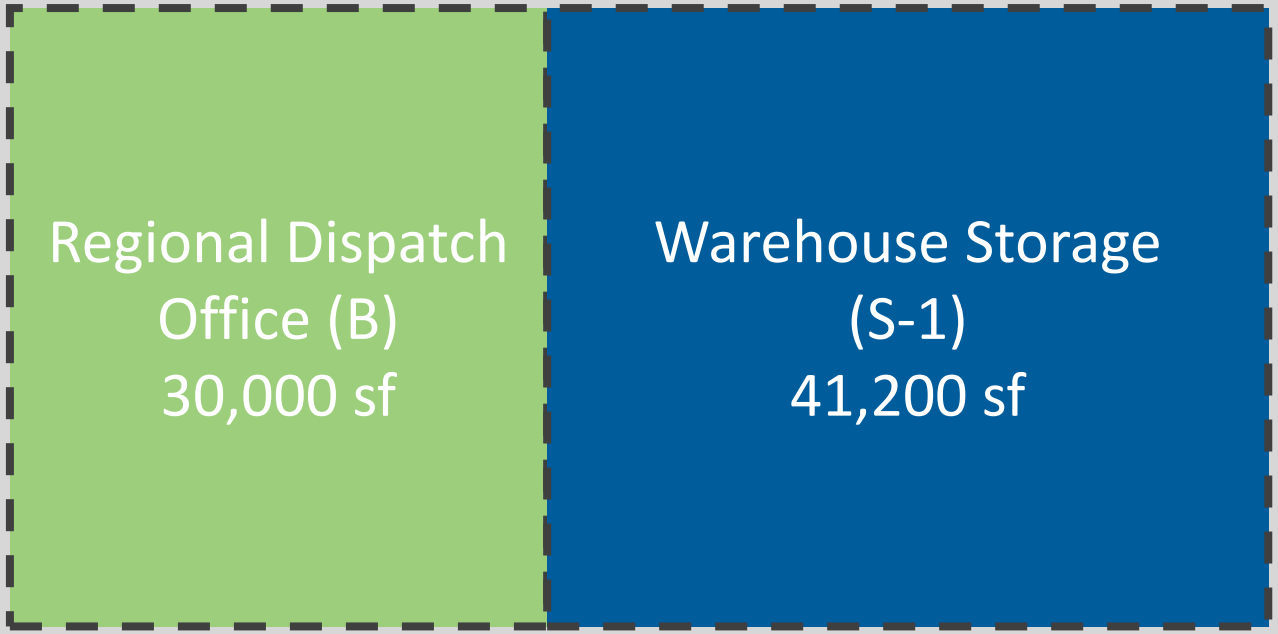


Mixed Occupancy Buildings: Nonseparated Occupancies



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

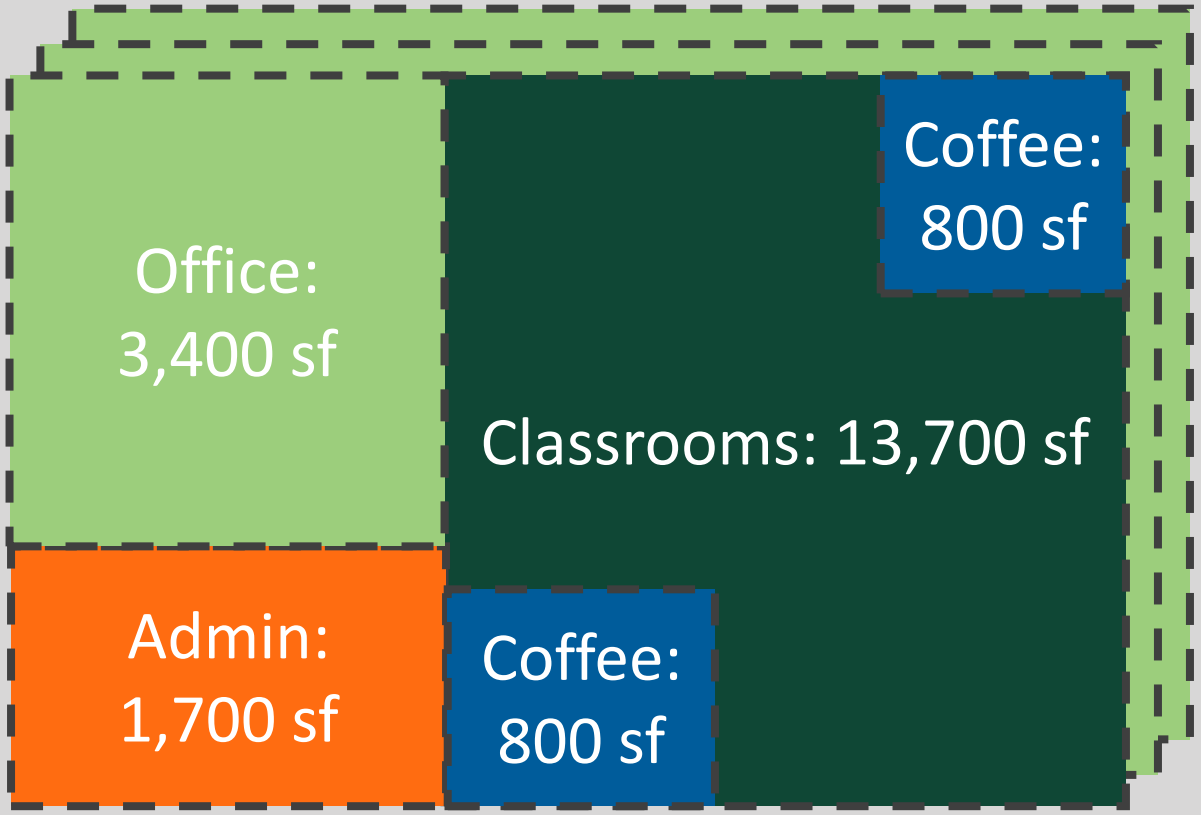
- Construction type options:
  - V-B: Not OK for B or S-1
  - V-A: OK for B, not OK for S-1
  - III-B: OK for B, not OK for S-1
  - **III-A: OK for both**

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: Multi-Story Nonseparated Occupancies



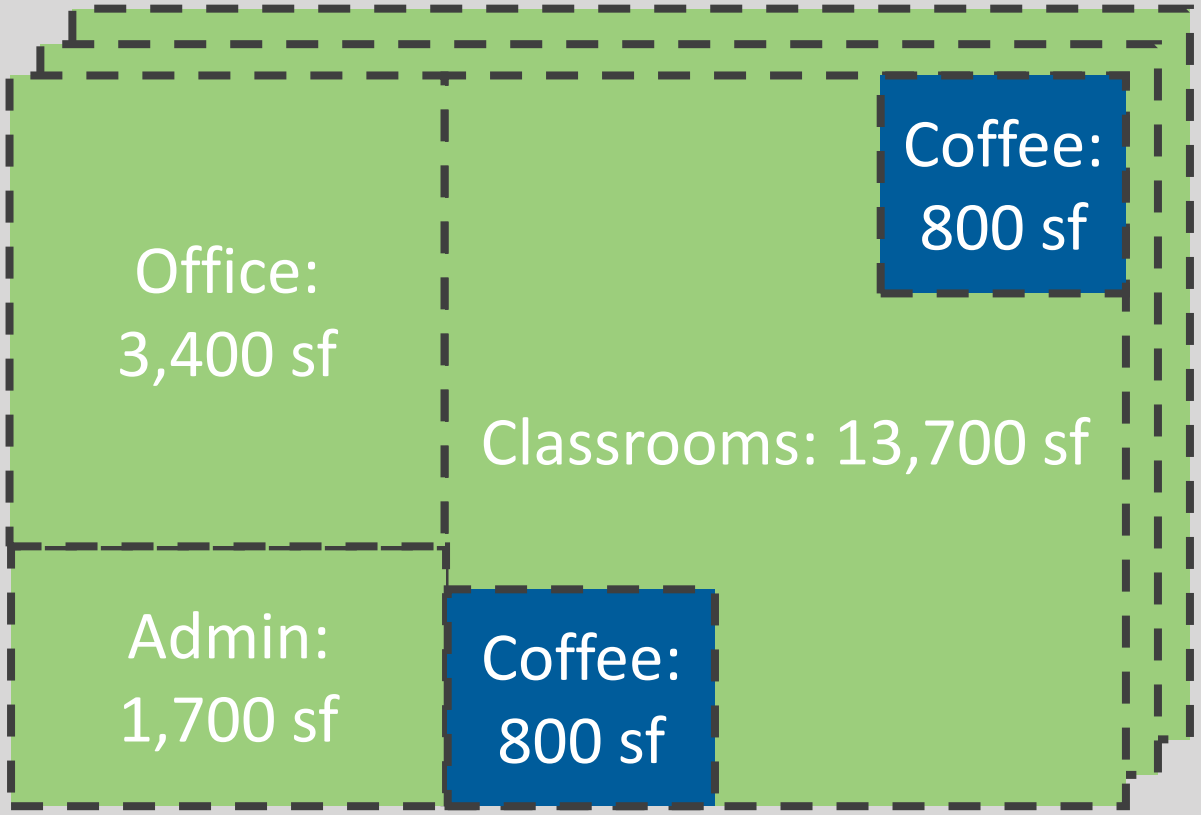
Totals: 20,400 sf/floor
61,200 sf total

- 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



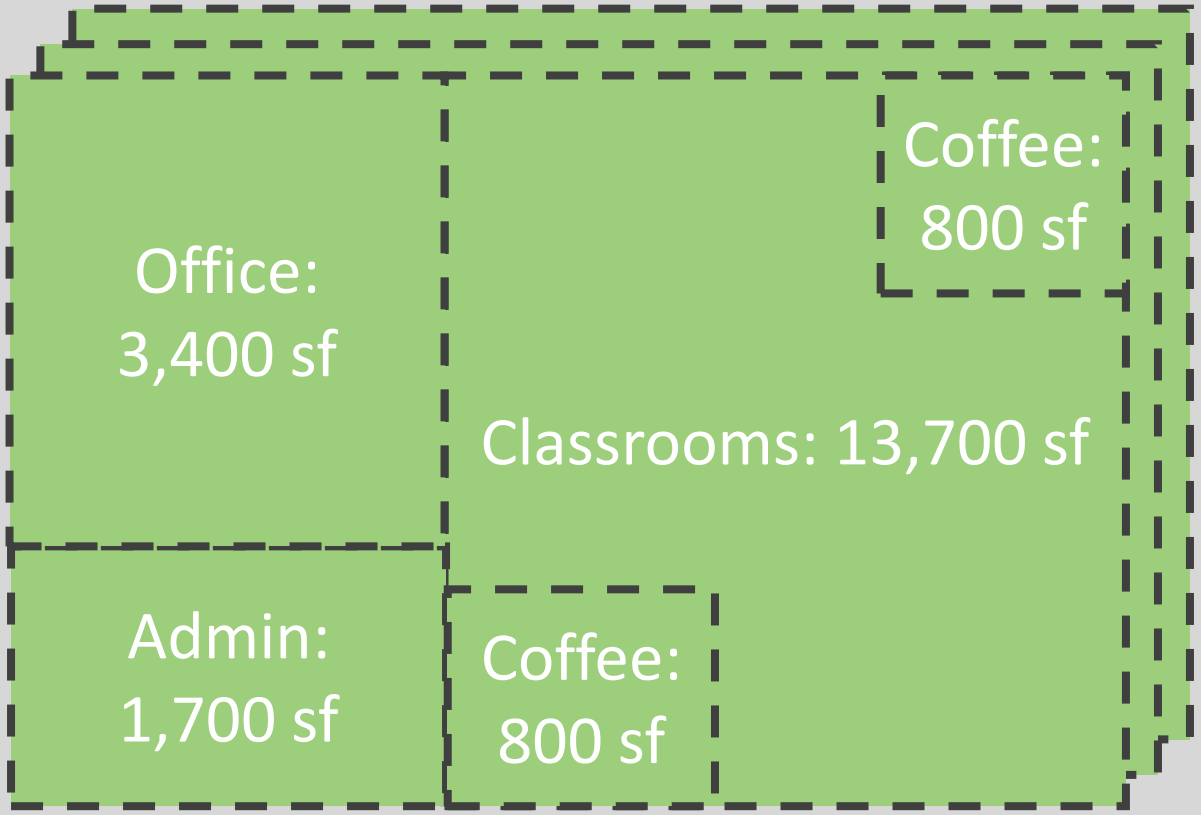
Totals: 20,400 sf/floor
61,200 sf total

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

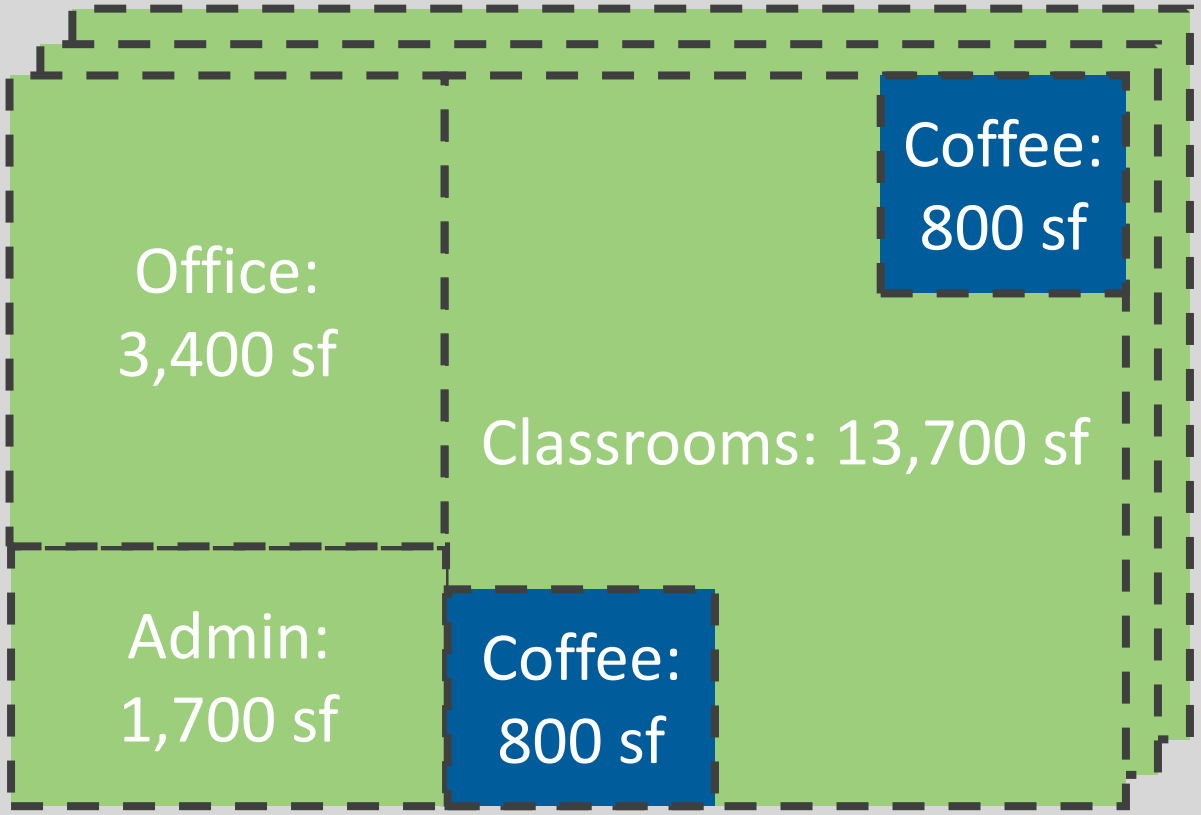
- Assume coffee / snack areas quality for small assembly or accessory occupancy
  - Entire building is Group B

→ **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

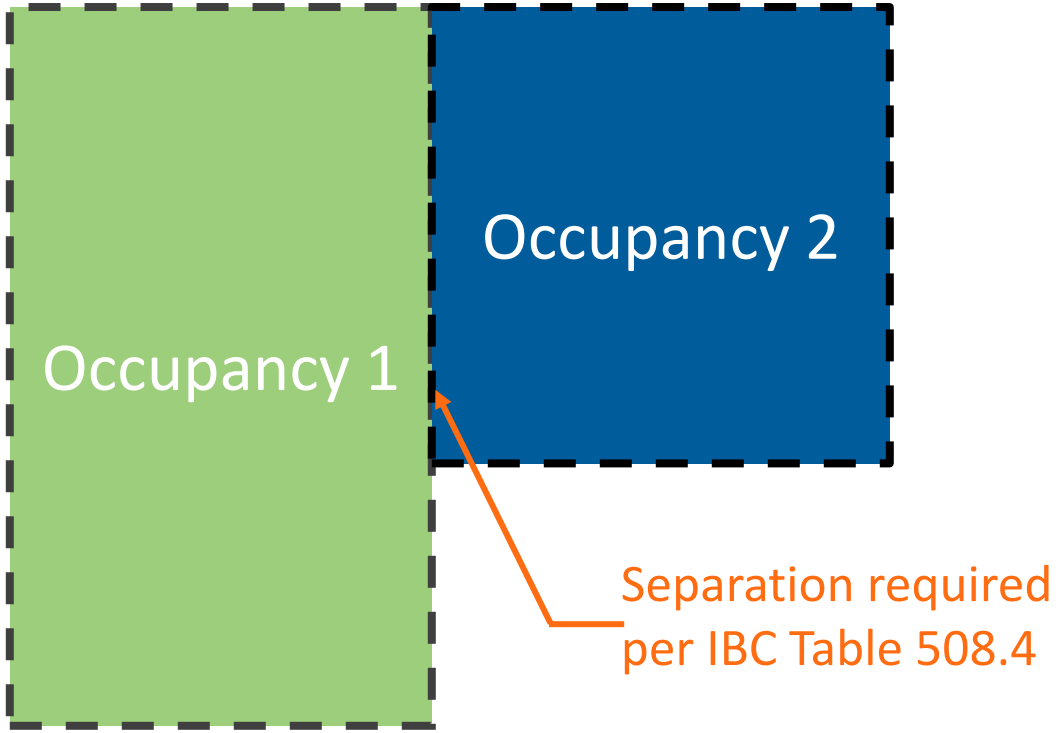
INTRO Cleveland / Hartshorne Plunkard Architecture / Forefront Structural Engineers / Fast + Epp / photo Nick Johnson, Tour D Space

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

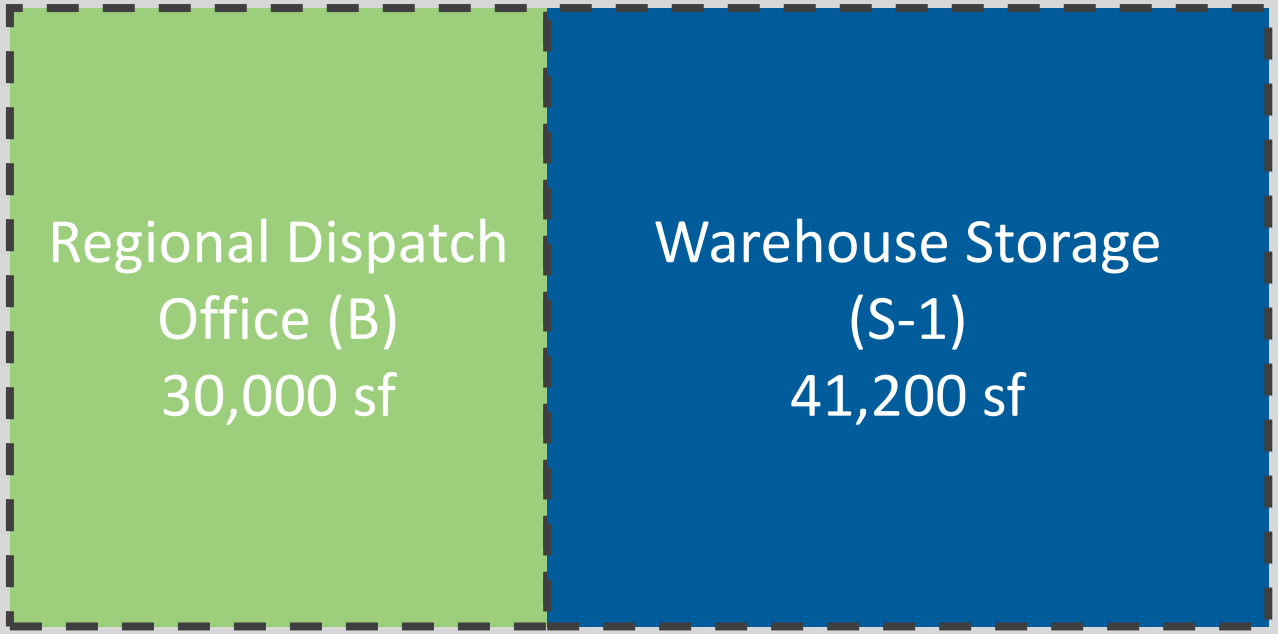
- **1, 2, 3**: FRR protection
- **NP**: Not Permitted
- **N**: No Separation Required

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

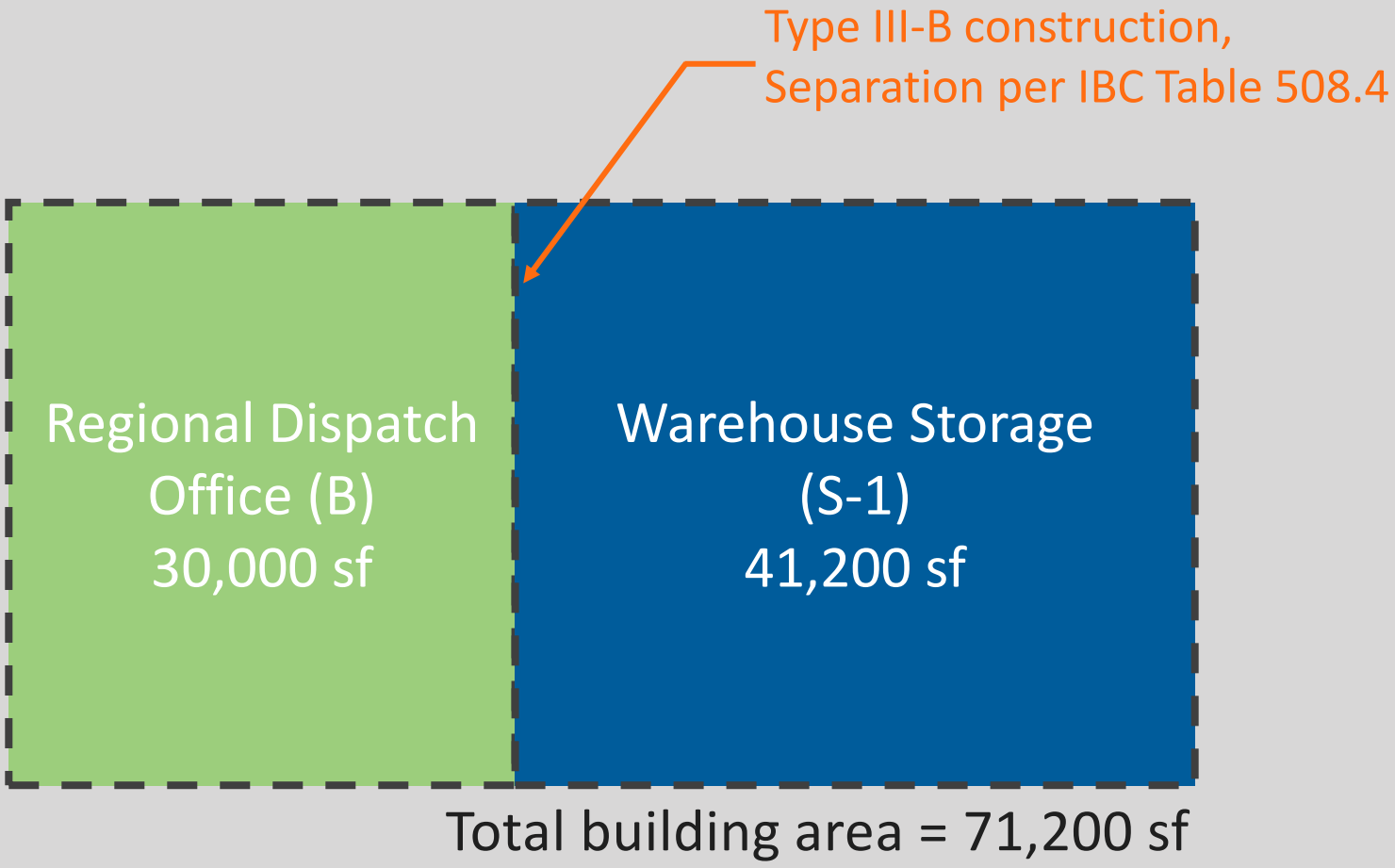
Assumptions: NFPA 13 sprinkler, No frontage increase

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-B 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

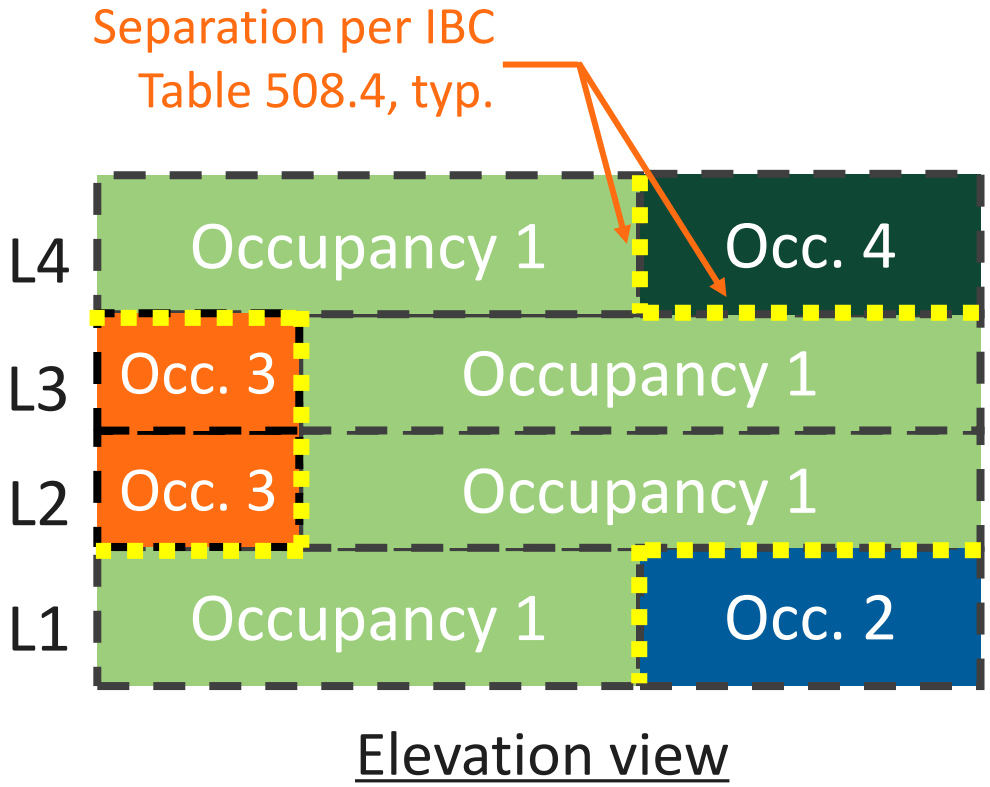
Mixed Occupancy Buildings: Separated Occupancies

Multi-story separated occupancies (IBC 508.4)

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

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

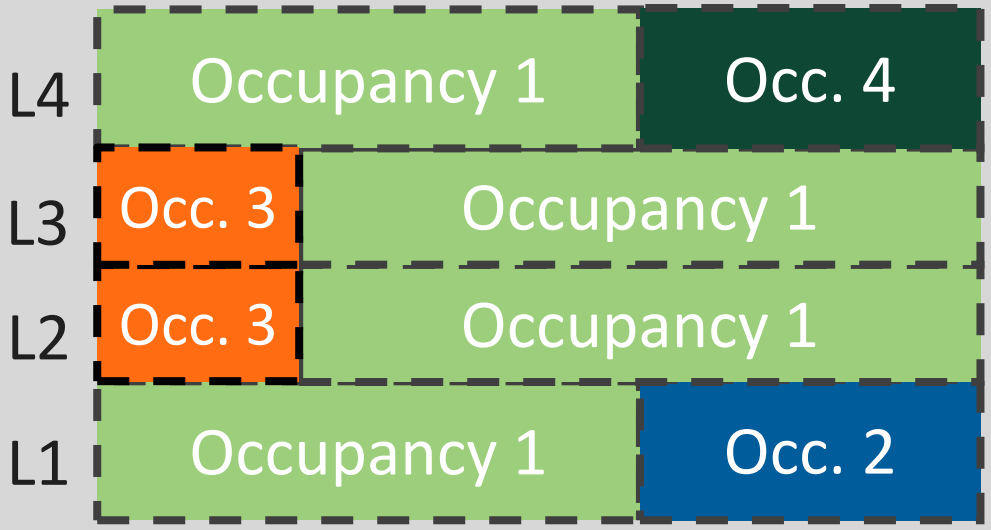
  - Sum of ratios for all floors
    - 1-story building: ≤ 1.0
    - 2-story building: ≤ 2.0
    - 3+ story building: ≤ 3.0



Elevation view

Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies



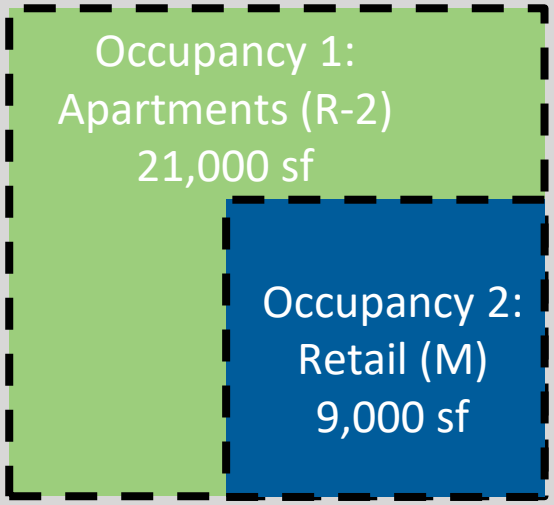
Elevation view

- 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)

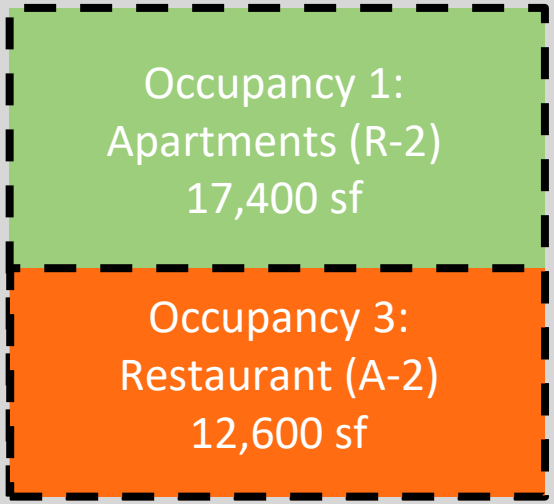
Mixed Occupancy Buildings: Separated Occupancies

Example: Multi-Story Separated Occupancies

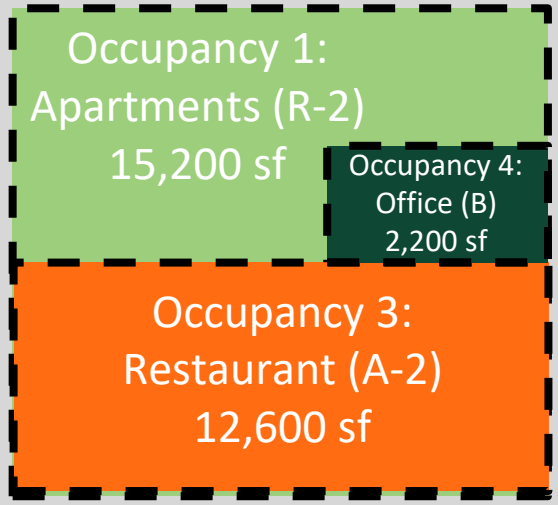
Level 1 Floor Plan



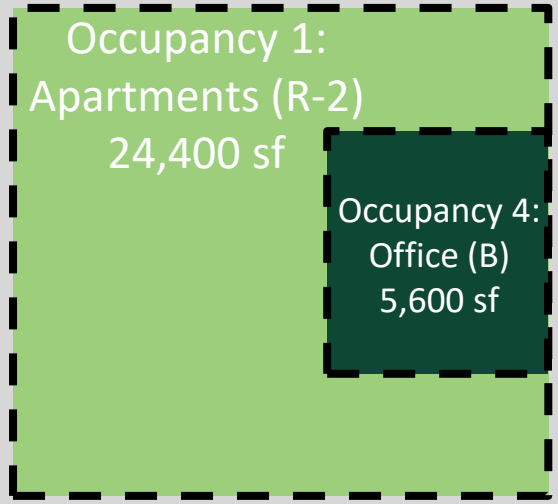
Level 2 Floor Plan



Level 3 Floor Plan



Level 4 Floor Plan



Mixed Occupancy Buildings: Separated Occupancies

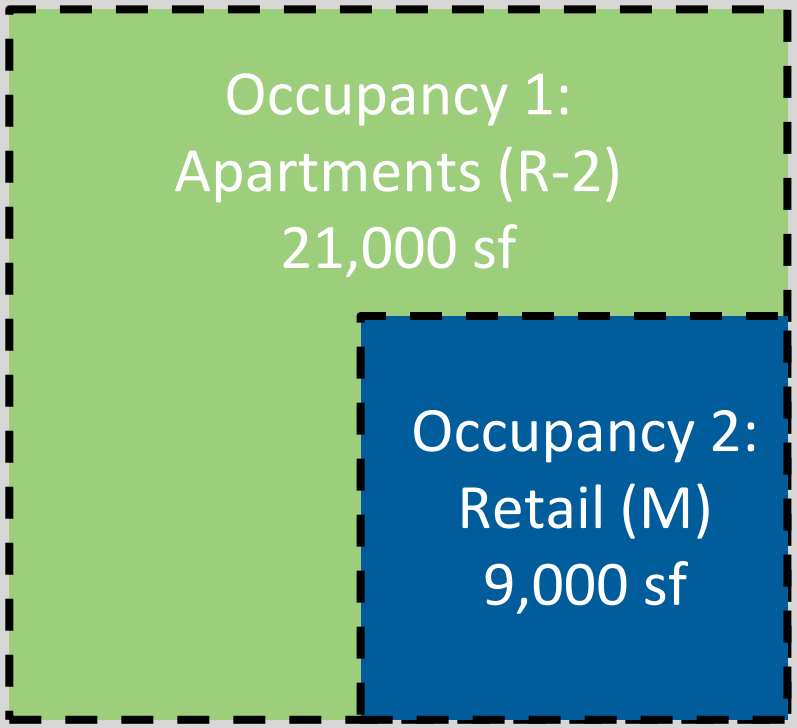
Example: Multi-Story Separated Occupancies

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



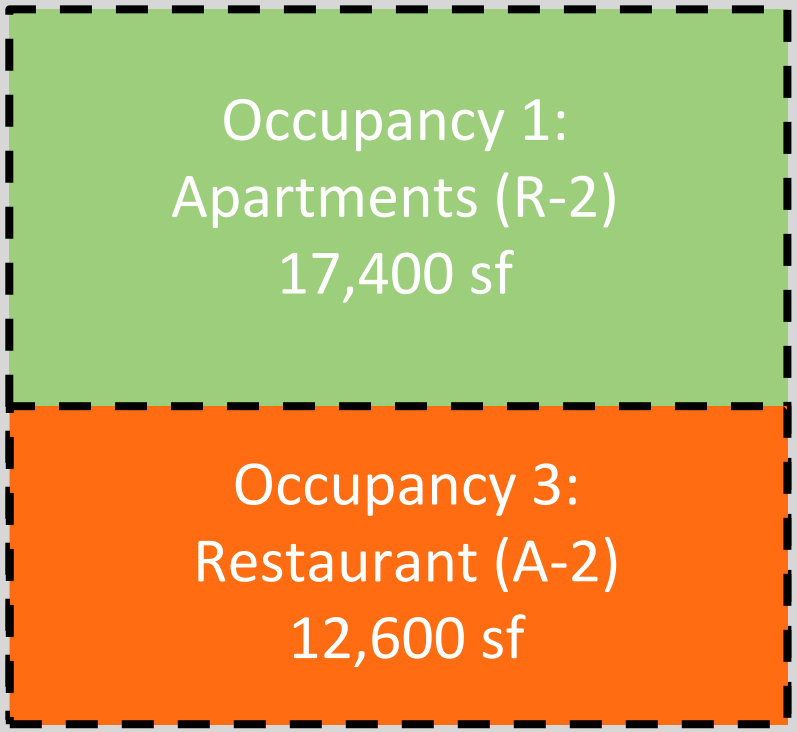
Level 1

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



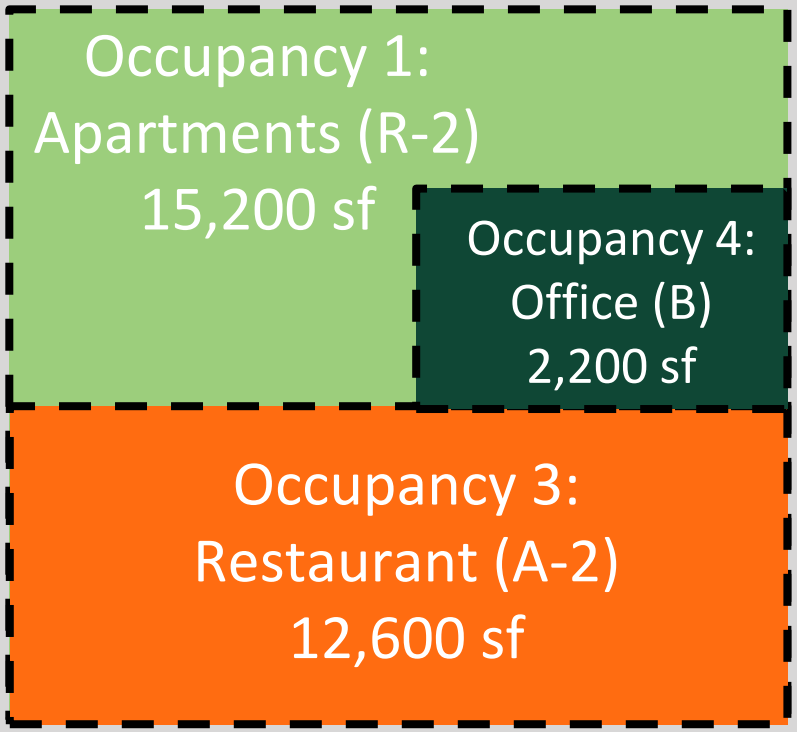
Level 2

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



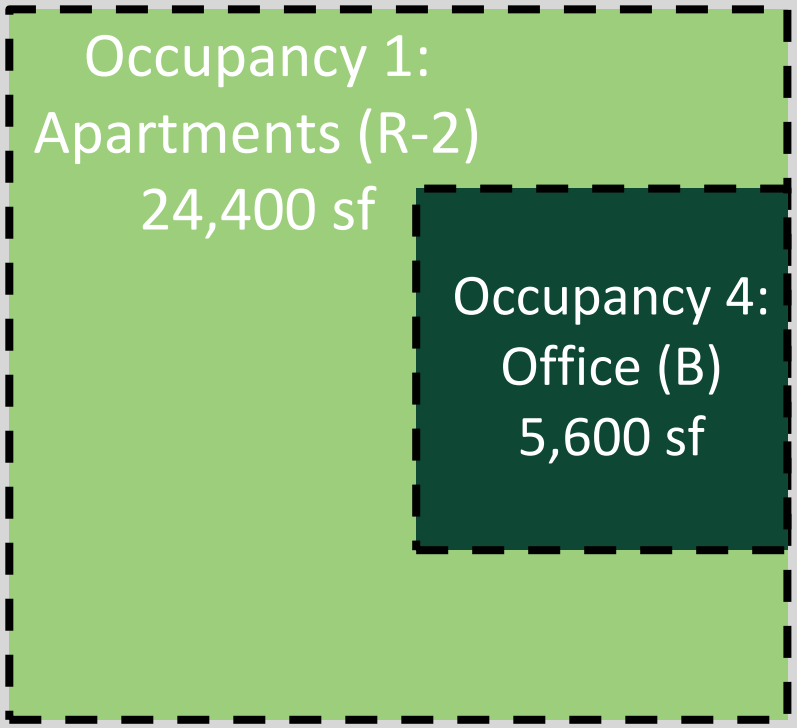
Level 3

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

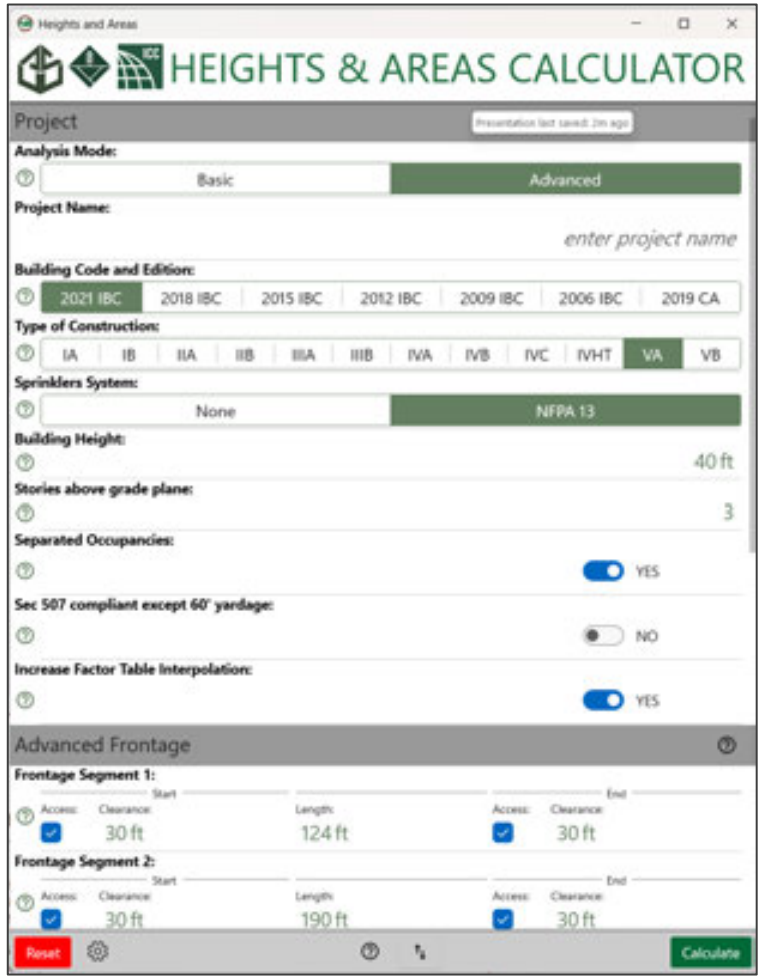
→ Use Type III-B

Mixed Occupancy Buildings: 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/

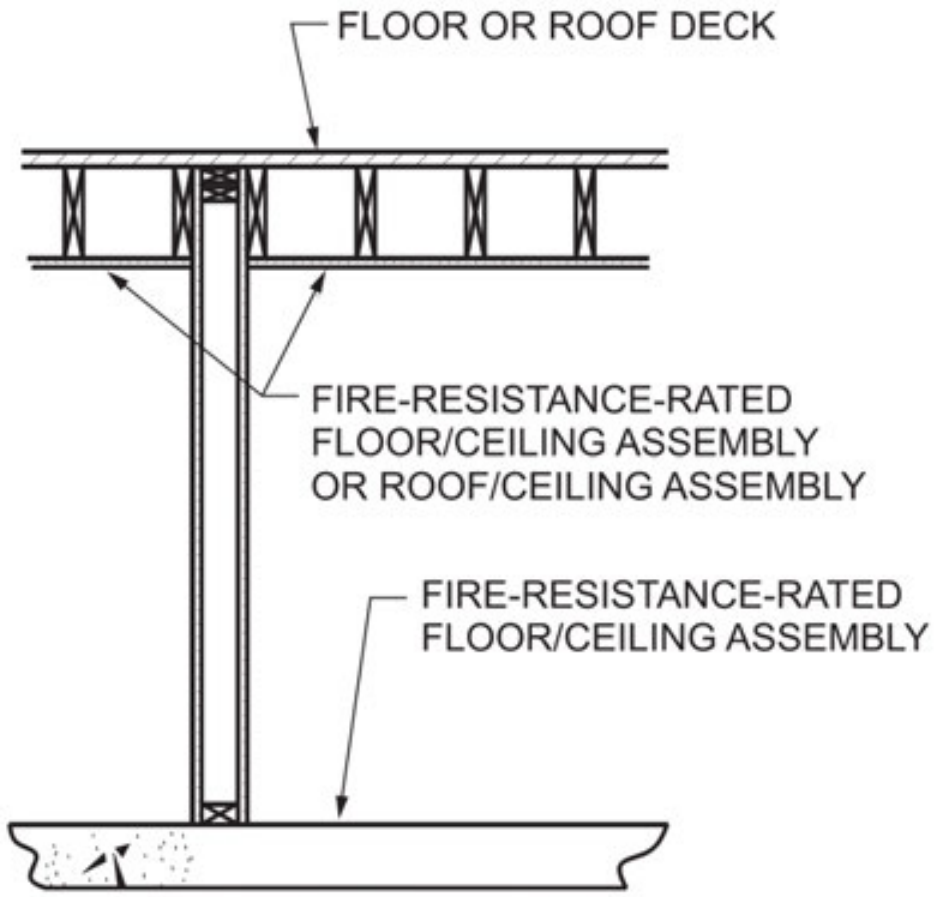


AWC Heights and Areas Calculator

Mixed Occupancy Buildings: Separated Occupancies

Walls: Fire Barrier (IBC 707)

- Any materials permitted by the construction type
- FRR:
  - Per IBC Table 508.4 for occupancy separation
  - Per IBC 713.4 for shaft enclosures
  - Per IBC Table 707.3.10 for fire areas
- Extent: Top of foundation/floor to underside of floor/roof sheathing, slab or deck above
- Supporting construction has same FRR



2021 IBC Code and Commentary – Volume 1, Commentary Figure 707.5

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

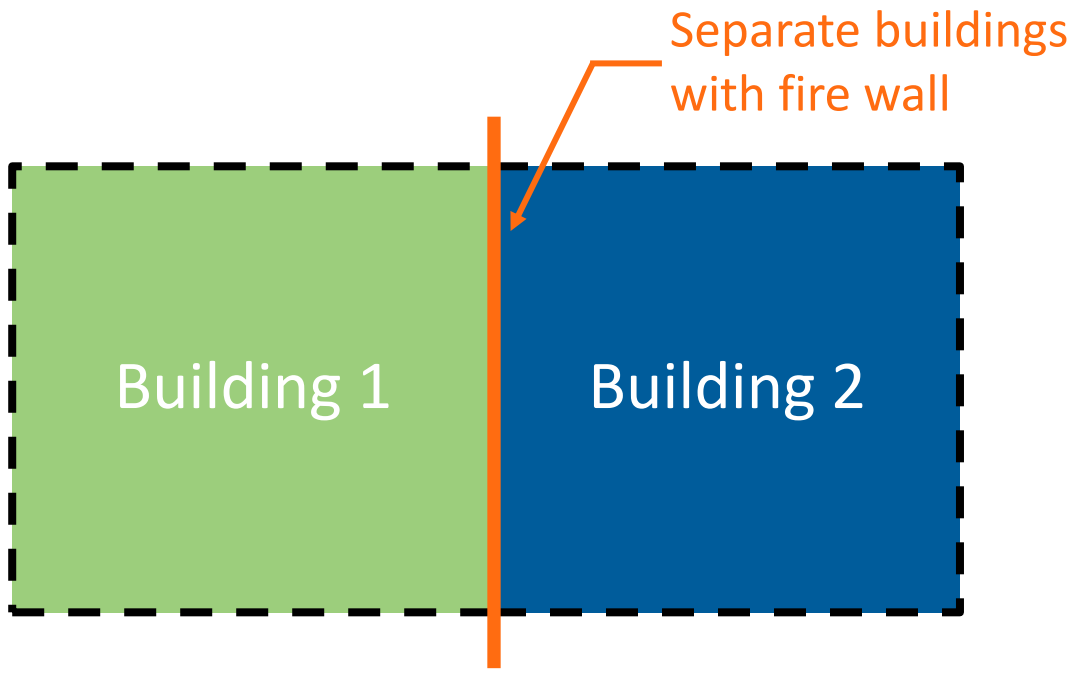
Mixed Occupancy Buildings: Separate Buildings

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 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.

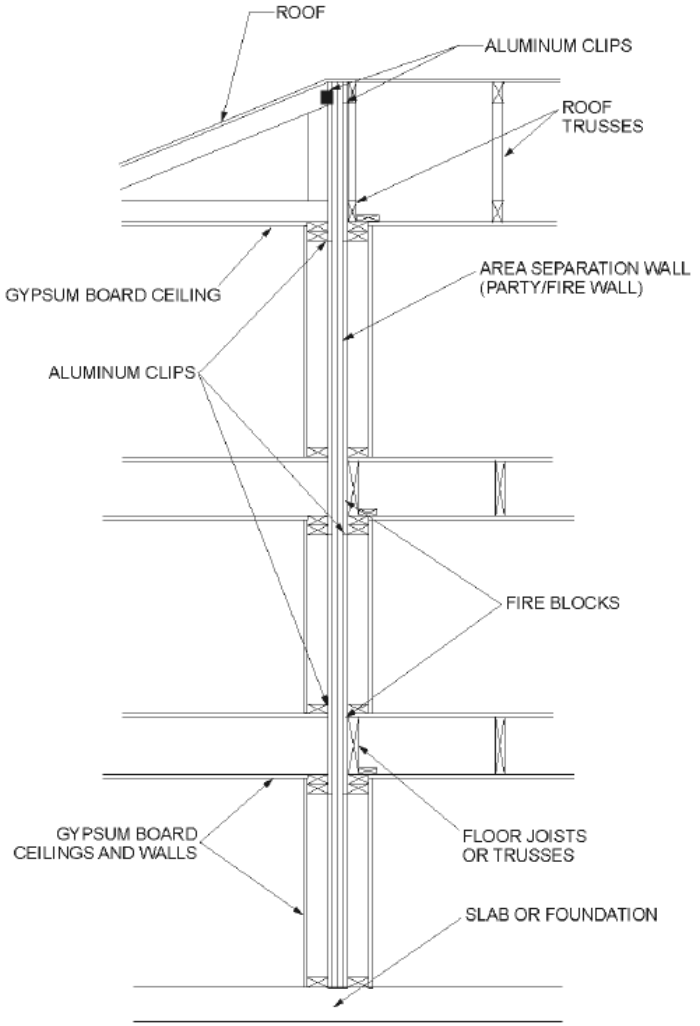
b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.7 and 415.8.

2021 International Building Code

Mixed Occupancy Buildings: Separate Buildings

Fire walls: 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

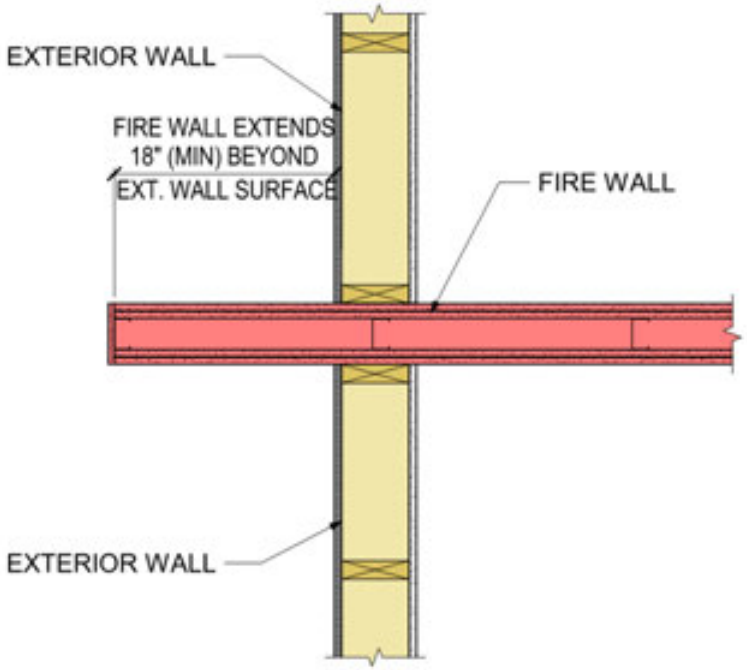


2021 IBC Code and Commentary – Volume 1, Commentary Figure 706.2(2)

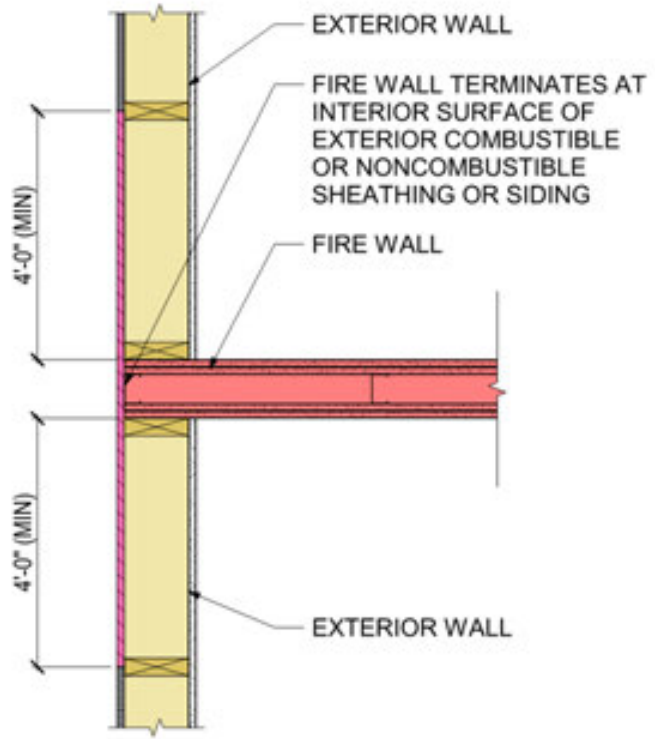
Mixed Occupancy Buildings: Separate Buildings

Fire walls: Horizontal continuity

- Fire walls continuous from exterior wall to exterior wall



FIRE WALL TO EXTERIOR WALL: OPTION 1

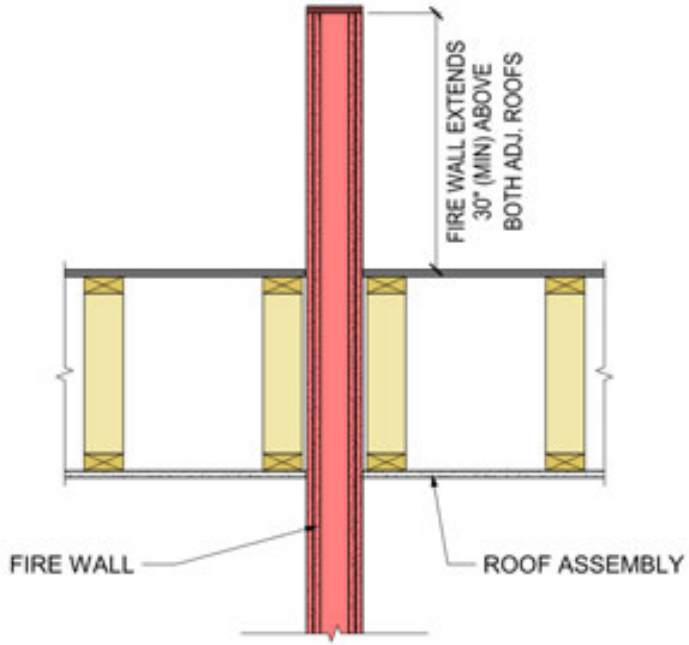


FIRE WALL TO EXTERIOR WALL: OPTION 2

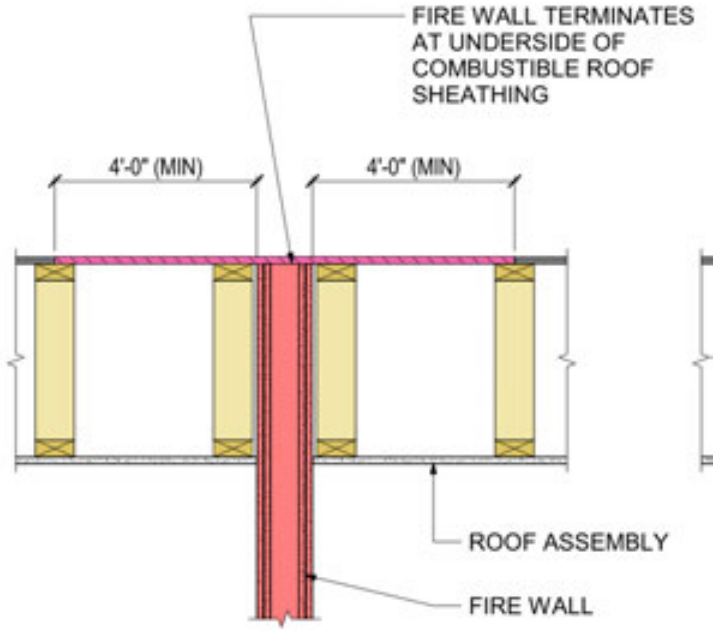
Mixed Occupancy Buildings: Separate Buildings

Fire walls: Vertical continuity

- Fire walls continuous from foundation to roof



FIRE WALL TO ROOF: OPTION 1

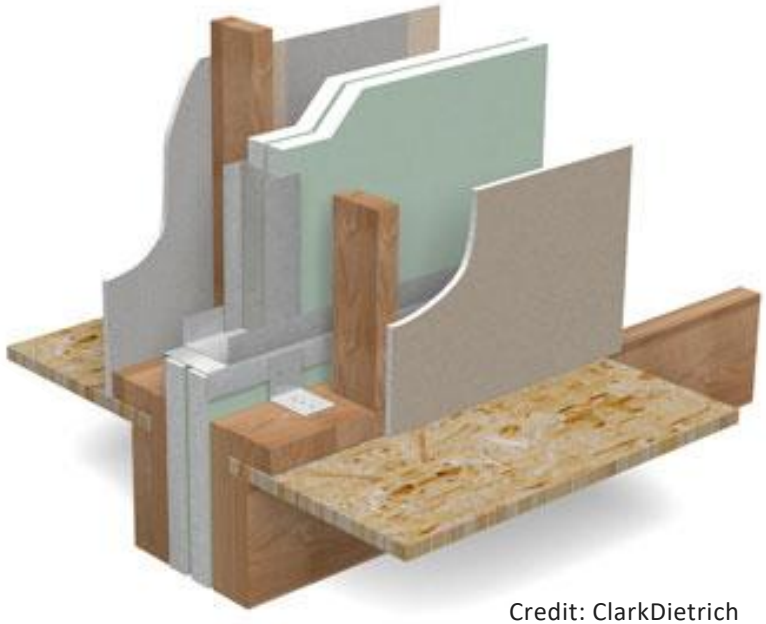


FIRE WALL TO ROOF: OPTION 2

Mixed Occupancy Buildings: Separate Buildings

Opportunity for wood-framed fire walls

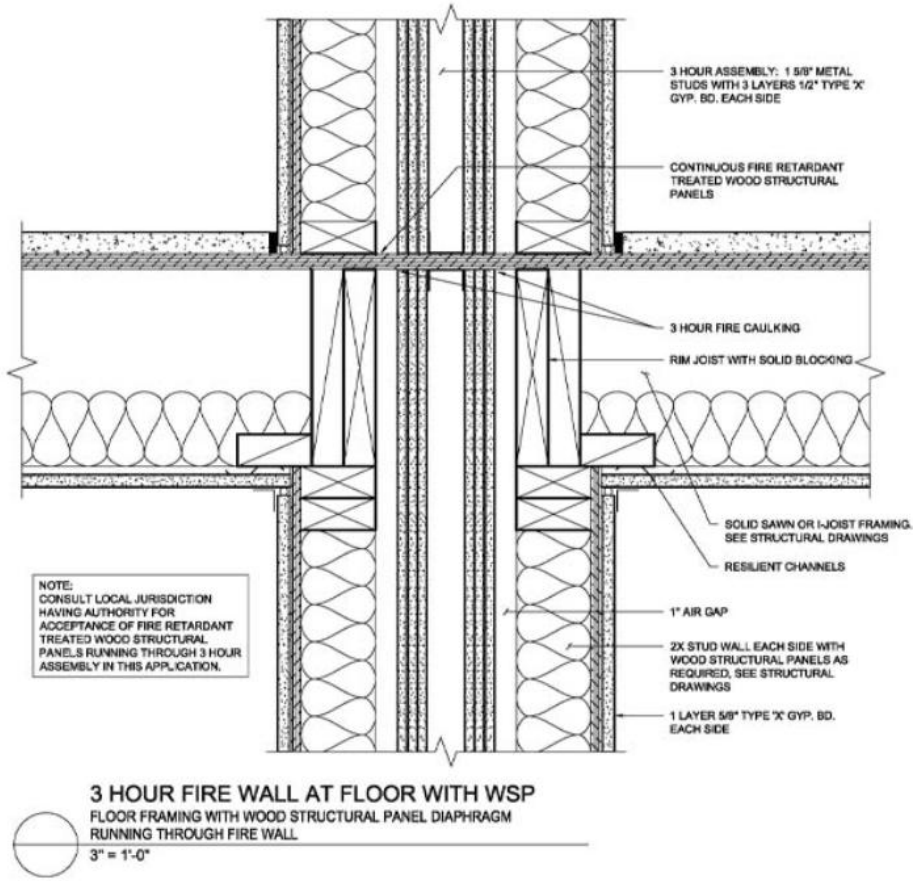
- Permitted in Type V construction
- Noncombustible materials required for Types III and IV construction
  - Opportunity for wood frame bearing walls on each side of fire wall to meet structural stability requirements

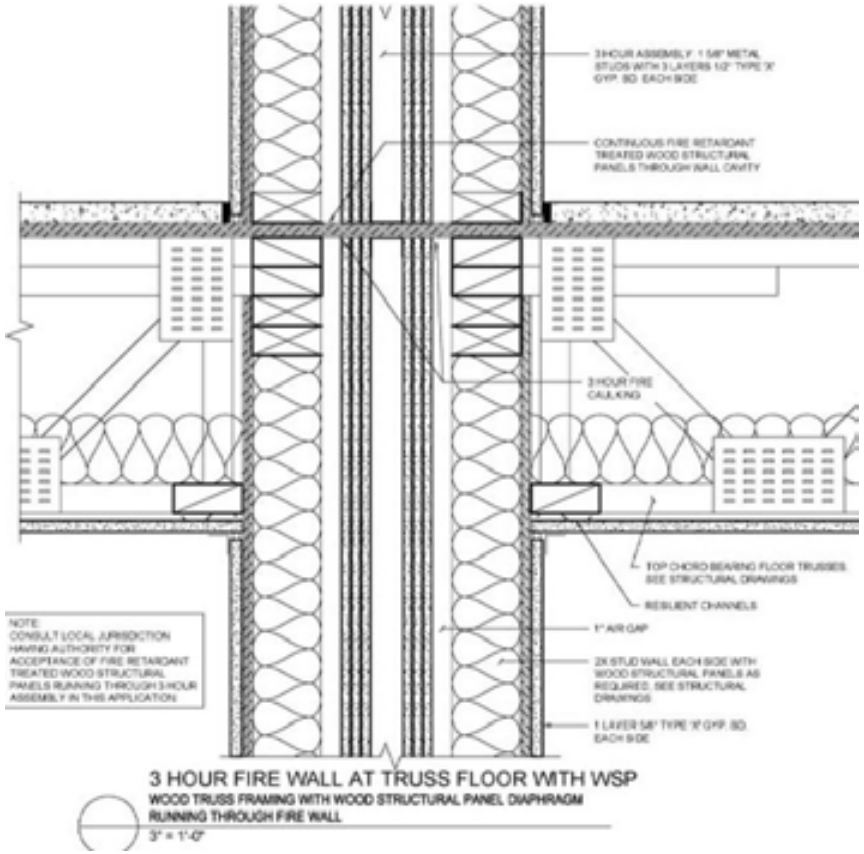


Credit: ClarkDietrich

Mixed Occupancy Buildings: Separate Buildings

Fire walls: Seismic diaphragm capacity





Mixed Occupancy Buildings: Separate Buildings

Fire walls: Seismic diaphragm capacity

SEAoSC LIGHT-FRAMING CONSTRUCTION COMMITTEE
STRUCTURAL ENGINEERS ASSOCIATION OF SOUTHERN CALIFORNIA
SEISMOLOGY OPINION

SEAOSC

DATE: **March 21, 2008**

Continuity of Plywood Diaphragm Sheathing in 2 hr and 3hr Fire Walls:

Opinion: The continuity of plywood diaphragm sheathing should be maintained across the air gap commonly encountered in double stud Firewalls of 2 or 3 hour construction. The intent is to ensure that structural continuity is not significantly reduced in the roof and floor diaphragms.

Commentary:

This opinion is prepared to address the issue of diaphragm continuity as it relates to recent changes in 2007 CBC and 2006 IBC model code. Specifically the outgoing UBC provisions for Area-Separation walls have more or less been replaced by the Fire wall provisions of the IBC. Such walls are encountered in light-frame multifamily or mixed-use construction and are often constructed as a double studwall when occurring at

QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

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Funding provided in part by the Softwood Lumber Board