Mixed-Occupancy Buildings: Design for Density with Confidence

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Photo: Eckert & Eckert Photography; GBD Architects

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

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 requirements of the International Building Code related to mixed-occupancy buildings, noting building size limits and fire resistance for separation.

2. Discuss options within the IBC for simplifying mixed-use building analysis, such as non-separated occupancies, incidental uses, special provisions and podium construction.

3. Highlight methods for incorporating parking and assembly spaces within multi-family structures, noting code compliance and layout options.

4. Demonstrate how to achieve separation of occupancies with fire barriers, fire walls and horizontal assemblies.

What is mixed-use?

Photo: Nicholas Wrey, courtesy of Applied Architecture, Inc.

Building with more than one occupancy group or intended function

Fire and Life Safety

IBC

The building code:

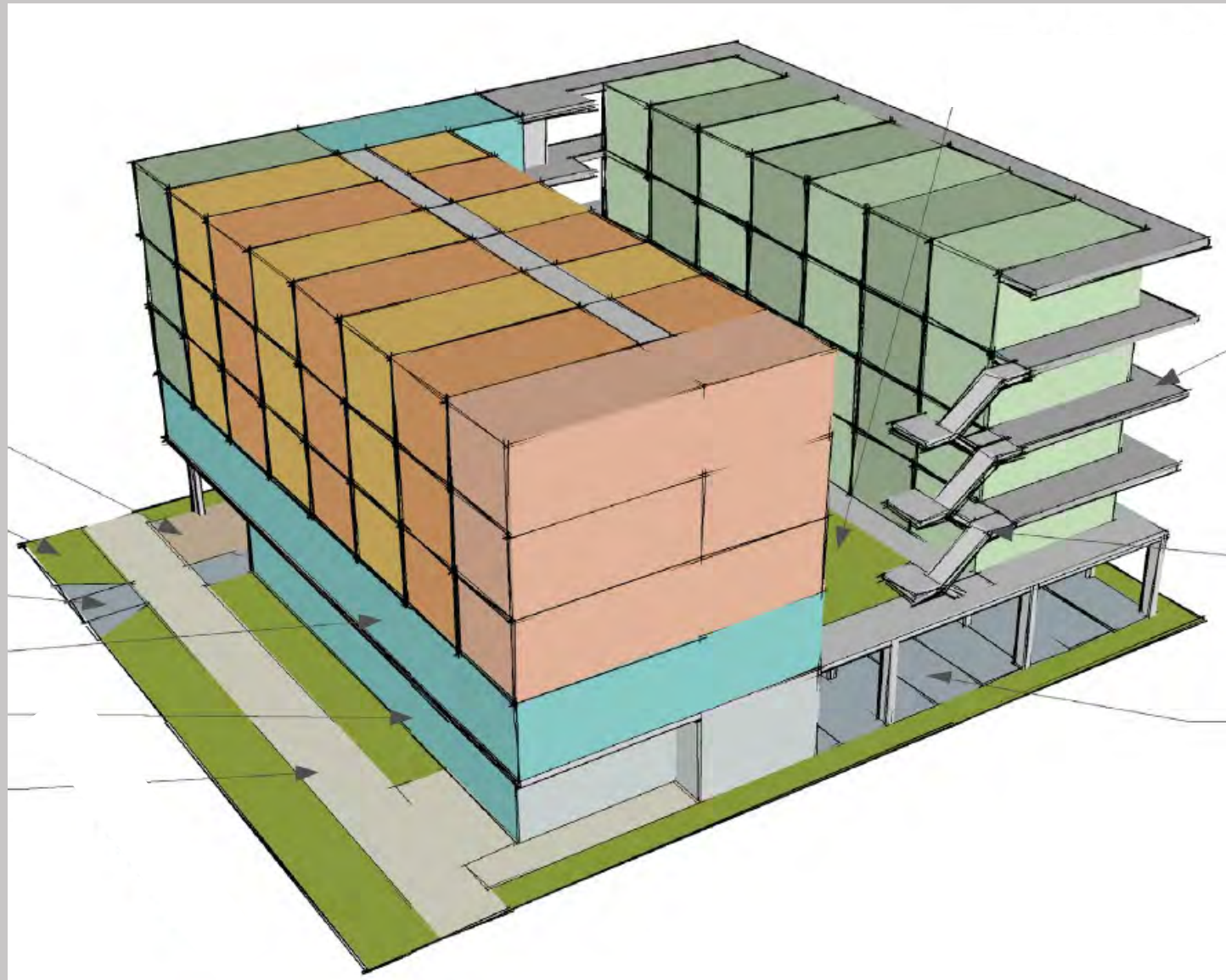
- Controls building size
- Regulates type of materials used
- Stipulates fire resistance

But…

The code still allows flexibility in building design, configuration, construction type, materials and other choices

Building Configuration Options

There are multiple ways to classify a building. Challenge tradition and consider all options to achieve the most cost-effective solution



Allowable Building Size

IBC Chapter 5

Allowable Building Size

IBC Chapter 5

Allowable building size a function of:

Fire department to access building

Building use

Construction type

Construction Types

IBC 602

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 are subdivided to A (protected) and B (unprotected)

Type IV (Heavy/Mass Timber)
Exterior walls non-combustible (may be FRTW)
Interior elements qualify as Heavy Timber (min. sizes, no concealed spaces)

Construction Types

Allowable Building Height

IBC Tables 504.3 & 504.4

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

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

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

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

Construction Types

Allowable Building Area

IBC Table 506.2

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

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

Allowable Building Size

IBC 506.2.3

Total building area

Total building allowable area =
Allowable area per floor
multiplied by:
2 for 2-story building
3 for 3- or more story buildings

What about mixed occupancies?

Mixed Occupancy Buildings

Start with the lowest common denominator option and work up. Don't assume that a certain construction type, occupancy separation, etc. will be required simply based on use of certain materials or presence of certain occupancies

Image: Neo Studio

Mixed Occupancy Buildings

Start with unseparated occupancies, using special provisions and/or other special design allowances as needed. Work up from there.

Mixed Occupancy Buildings

IBC 508

- Incidental Uses (509)
- Accessory occupancies (508.2)
- Unique occupancy combinations (303)
- Non-Separated occupancies (508.3)
- Separated Occupancies (508.4)
- Special provisions (510)

Credit: Boye Architecture

Incidental Uses

IBC 509

- Ancillary function associated with an occupancy
- Pose GREATER risk than the main occupancy
- Examples:
  - Laundry room over 100 sf
  - Refrigerant machinery room
  - Incinerator room
  - Furnace room
  - Boiler room
  - Vocational shop in a school

Incidental Uses

IBC 509

Limitations:

- Each area not more than 10% of story
- Have fire resistance rated separation (fire barrier or horizontal assembly), smoke separation and/or sprinkler systems per Table 509 and Section 509.4
  - Many permit use of sprinklers in lieu of rated separation
- NOT classified as a different occupancy.
- Allowable area and height per main occupancy

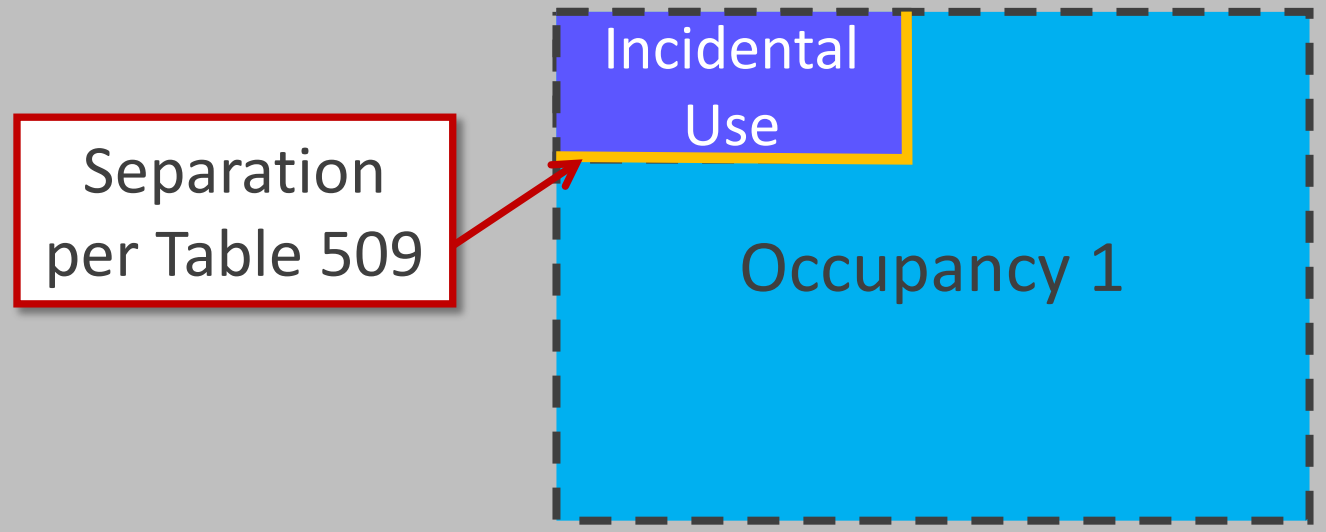


Photo Sean Hackbarth/Flickr

Incidental Uses

IBC 509

Incidental uses example:

- NFPA 13 sprinklered, 4 story, type VA building
- Upper 3 floors: 18,000 sf apartments (R-2)
- 1st floor: 16,000 sf apartments plus 1,000 sf laundry room & 1,000 sf boiler room
- Total building area = 72,000 sf

- Allowable incidental use area:
  = 18,000*10% = 1,800 sf > 1,000 sf
  OK: classify laundry room & boiler room as R-2
- Table 509: walls and floor separating laundry room & boiler room from R-2: no hourly rating required since bldg is sprinklered, but smoke resistance is required in conjunction with sprinklers per Section 509.4.2

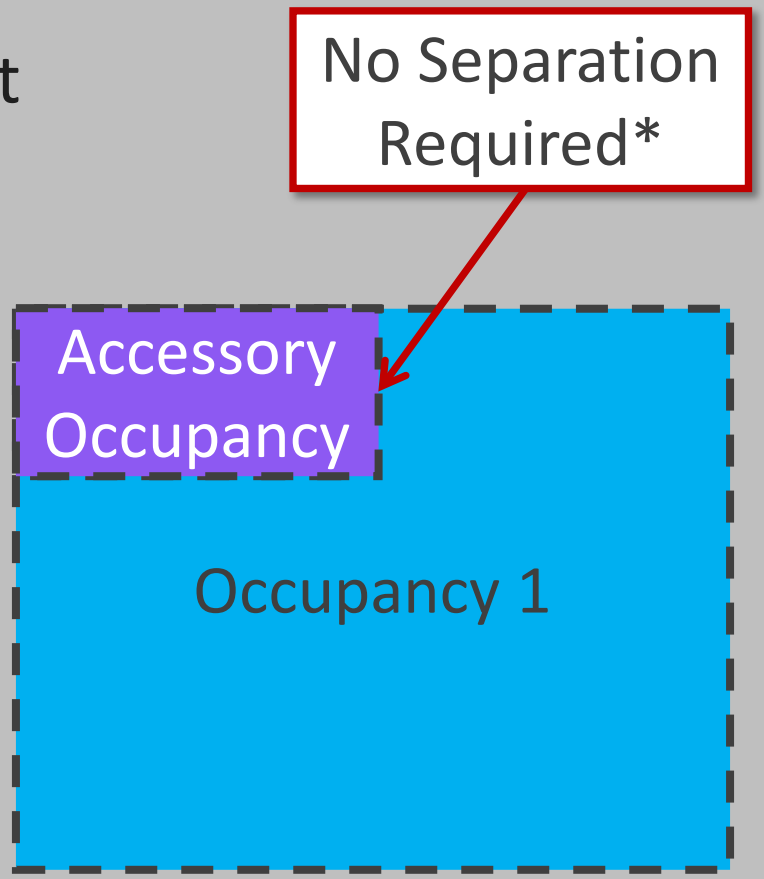
Accessory Occupancies

IBC 508.2

- Ancillary to the main occupancy
- Aggregate accessory area not greater than:
  - 10% of the main occupancy on same floor
  - Table 506.2 non-sprinklered allowable area limit of accessory occupancy
- No separation between occupancies required*
- Allowable building area and height per main occupancy

*Hazardous occupancies require separation

*Residential separations per Section 420 still apply



Accessory Occupancies

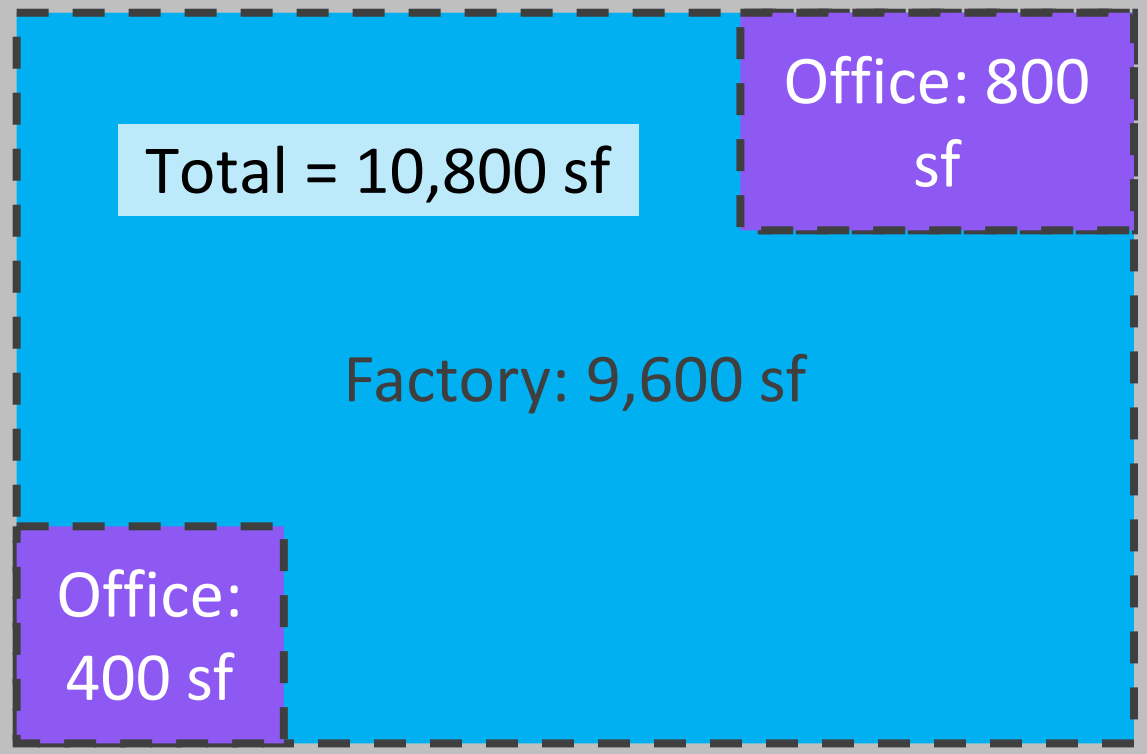
IBC 508.2

Accessory occupancies Example:

- Unsprinklered, 1 story, type VA building
- Factory (F-1) 9,600 sf
- Two office (B) spaces: 400 sf and 800 sf

- Aggregate Accessory use areas = 1,200 sf
- Max. allowable aggregate accessory use area = 10,800*10% = 1,080 sf

- Does not work as accessory occupancies
- Solution: reduce office area, increase factory area or use mixed-use occupancies



Small Assembly Spaces

IBC 303.1.1 & 303.1.2

Small Assembly Spaces:

- A building or tenant space used for assembly purposes with an occupant load of less than 50 persons shall be classified as a Group B occupancy.

Example: small café

Small Assembly Spaces Accessory to Other Occupancies:

- Occupant load less than 50 persons or less than 750 sf in area - can be classified as a Group B occupancy or as part of main occupancy

Examples:

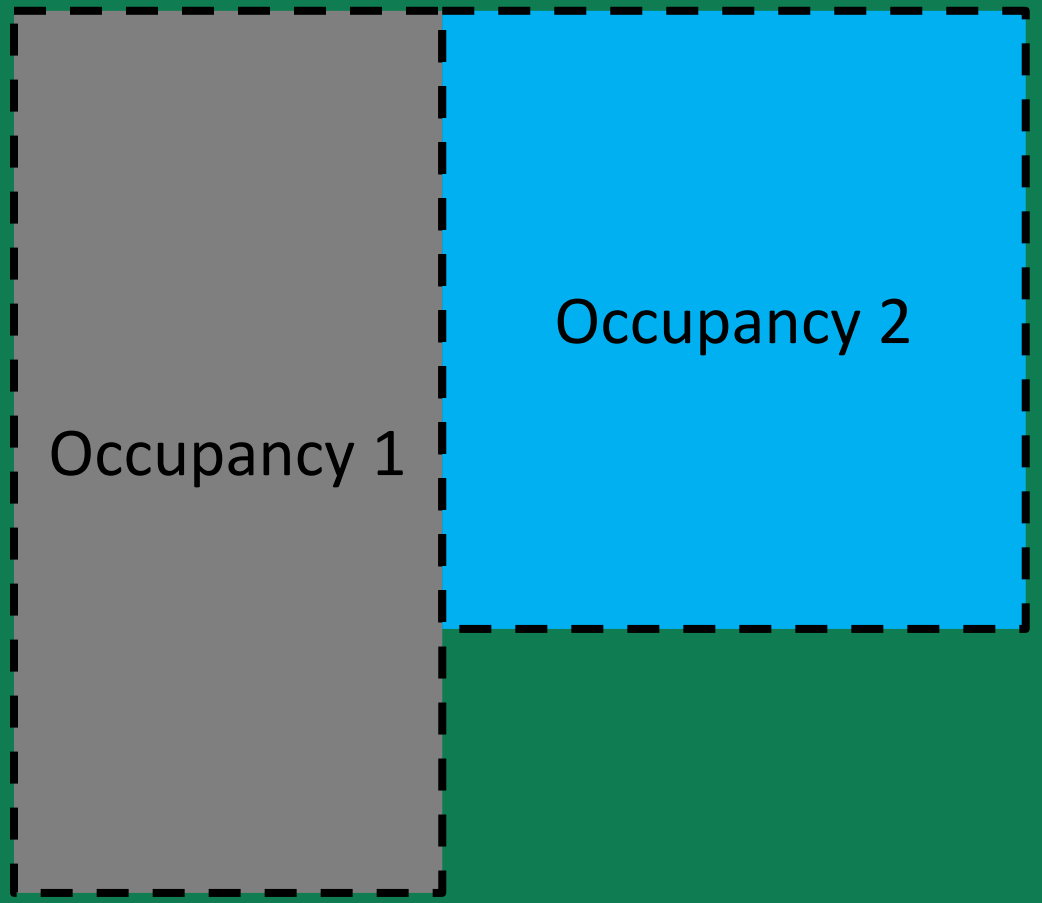
- Conference room in office building
- Fitness center in hotel

Nonseparated Occupancies

Allowable Building Size

IBC 508

Nonseparated occupancies

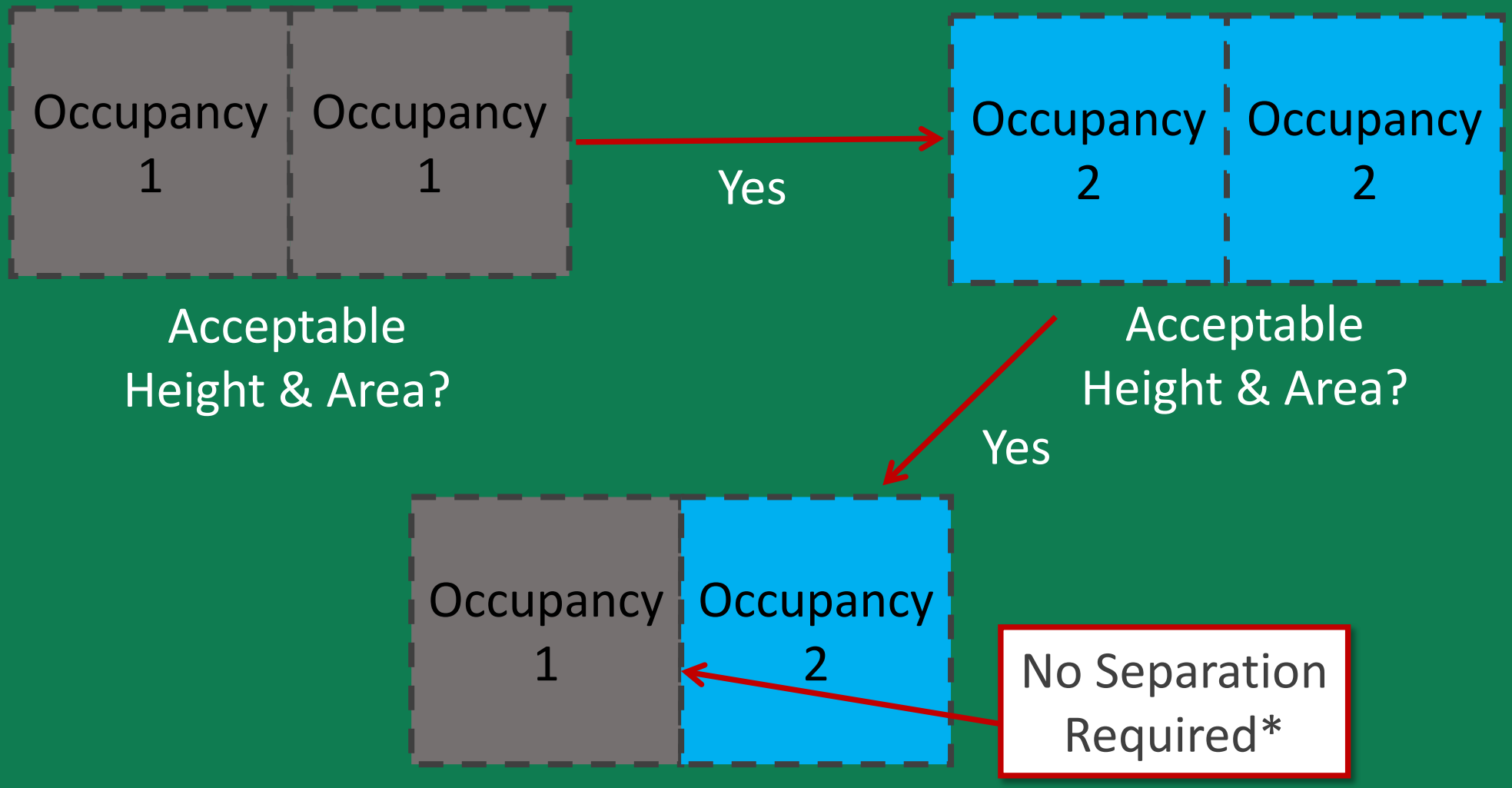


- Most restrictive of all occupancies apply for:
  - Fire Protection Systems (Ch. 9)
  - Allowable Height and Area (Ch. 5)
- Other requirements (i.e. egress, others) based on individual occupancy of each portion
- No fire separation between occupancies required*

*Hazardous occupancies require separation.

Nonseparated Occupancies

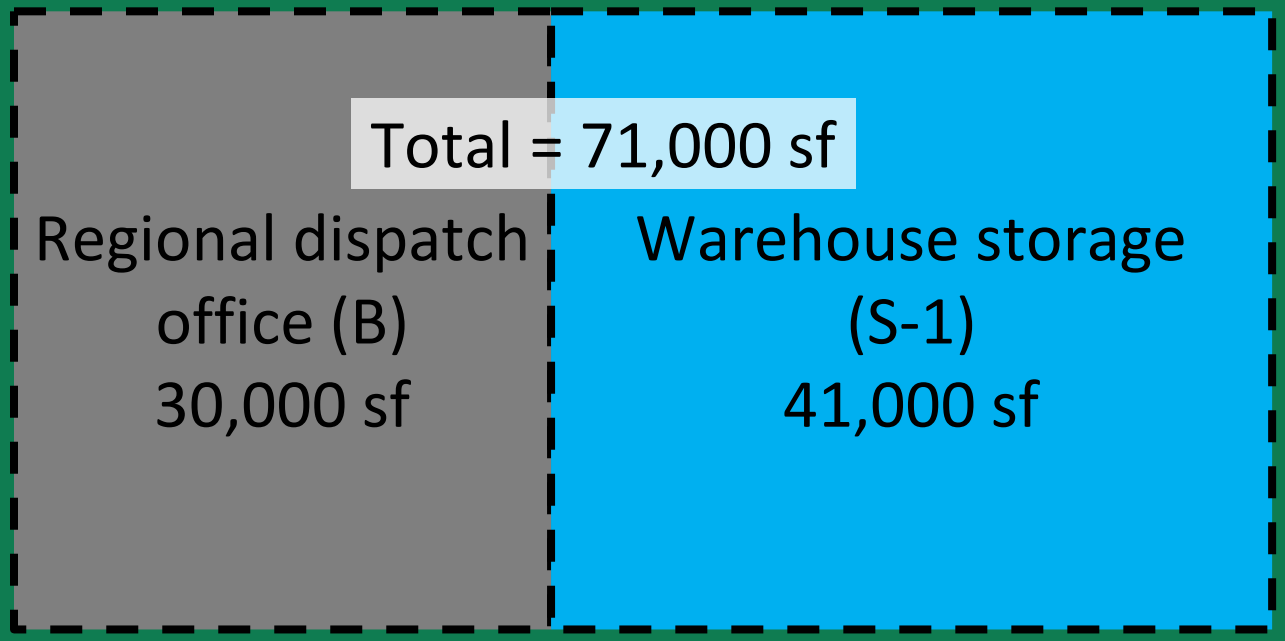
IBC 508.3



Allowable Building Size

IBC 508

Nonseparated occupancies example

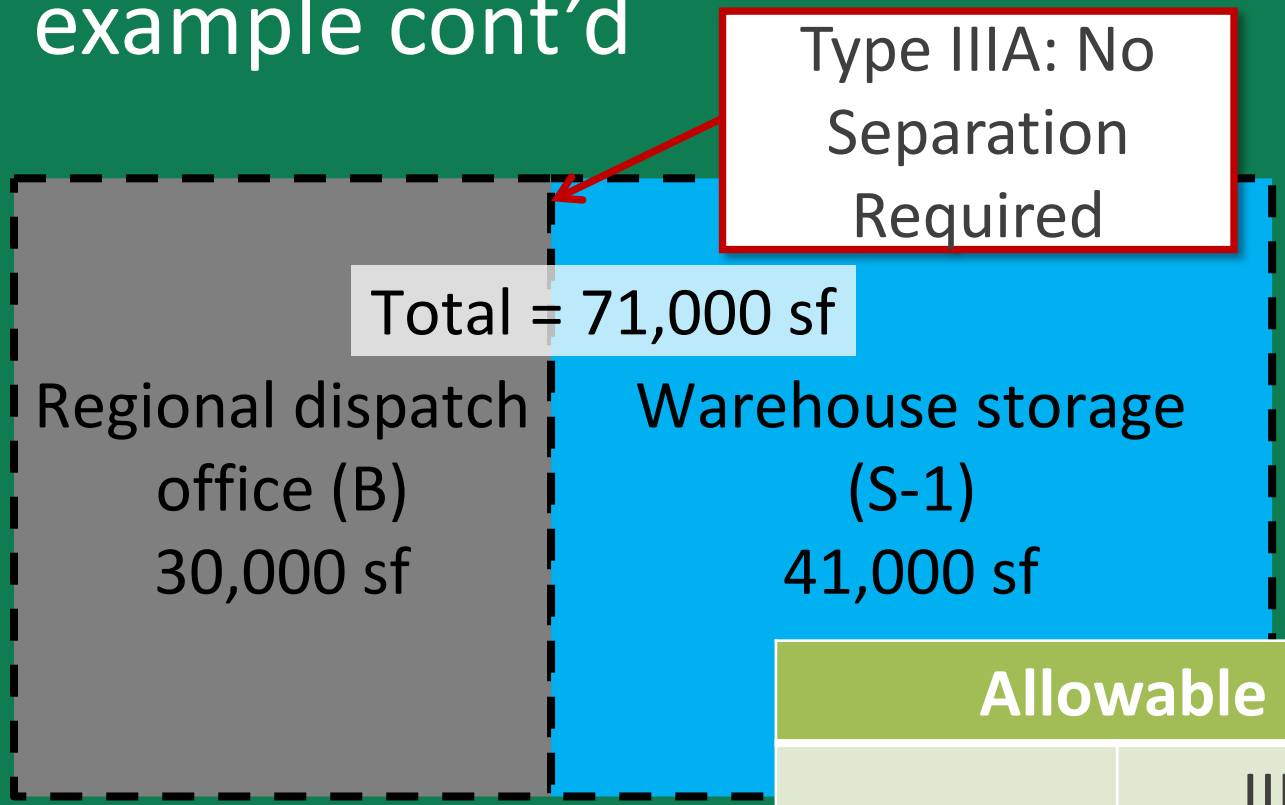


- 1 story building
- Total building area = 71,000 sf
- IBC section 903 does not require an automatic sprinkler in group B buildings, but it does for S-1 buildings with fire area > 12,000 sf (903.2.9)
- NFPA 13 sprinkler required throughout building

Allowable Building Size

IBC 508

Nonseparated occupancies example cont'd



Construction type options

- VB: inadequate for both
- VA: OK for B, inadequate for S-1
- IIIB: OK for B, inadequate for S-1
- IIIA: works for both!

Allowable 1-Story Building Area (Table 506.2)				
	IIIA	IIIB	VA	VB
Group B	114,000 sf	76,000 sf	72,000 sf	~~36,000 sf~~
Group S-1	104,000 sf	~~70,000 sf~~	~~56,000 sf~~	~~36,000 sf~~

Assumptions:
NFPA 13 sprinkler throughout
No frontage increase

Allowable Building Size

IBC 508

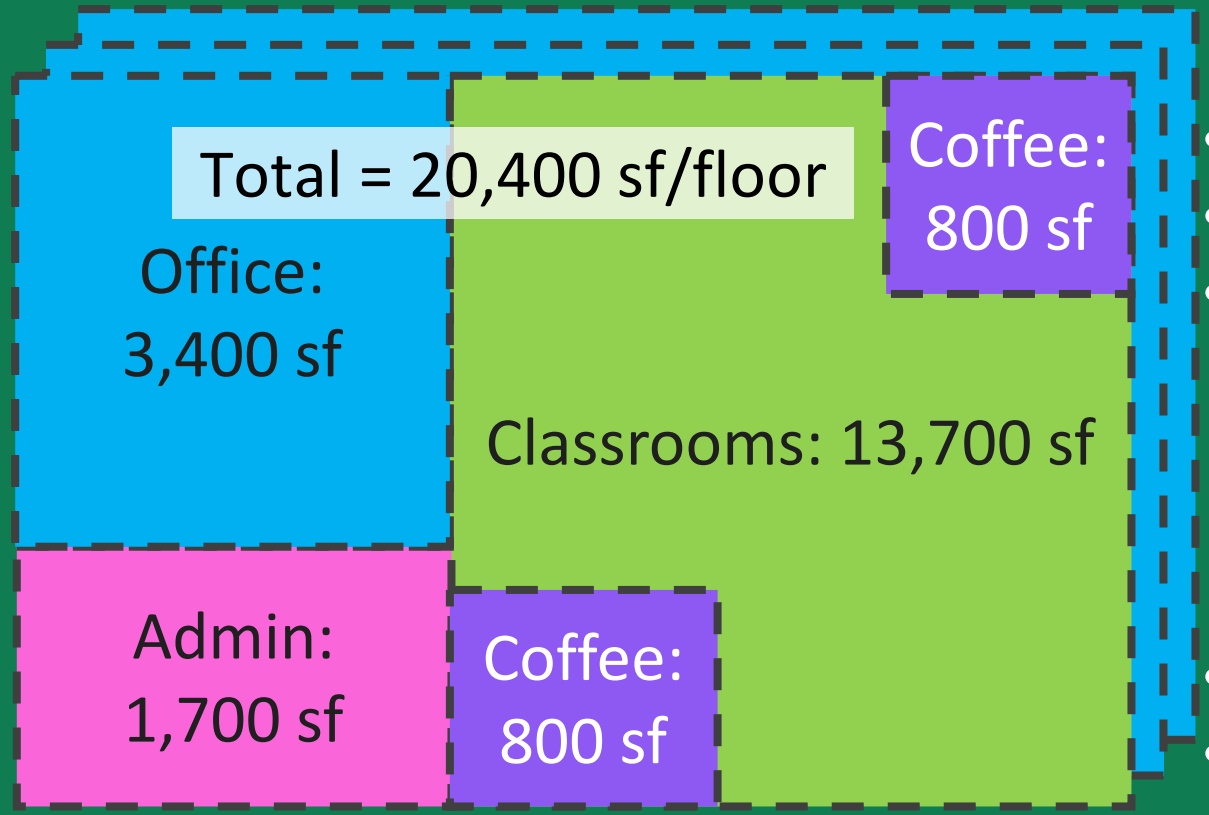
Image credit: ware malcomb

Multi-story nonseparated occupancy buildings

Allowable Building Size

IBC 508

Multi-story nonseparated occupancies example

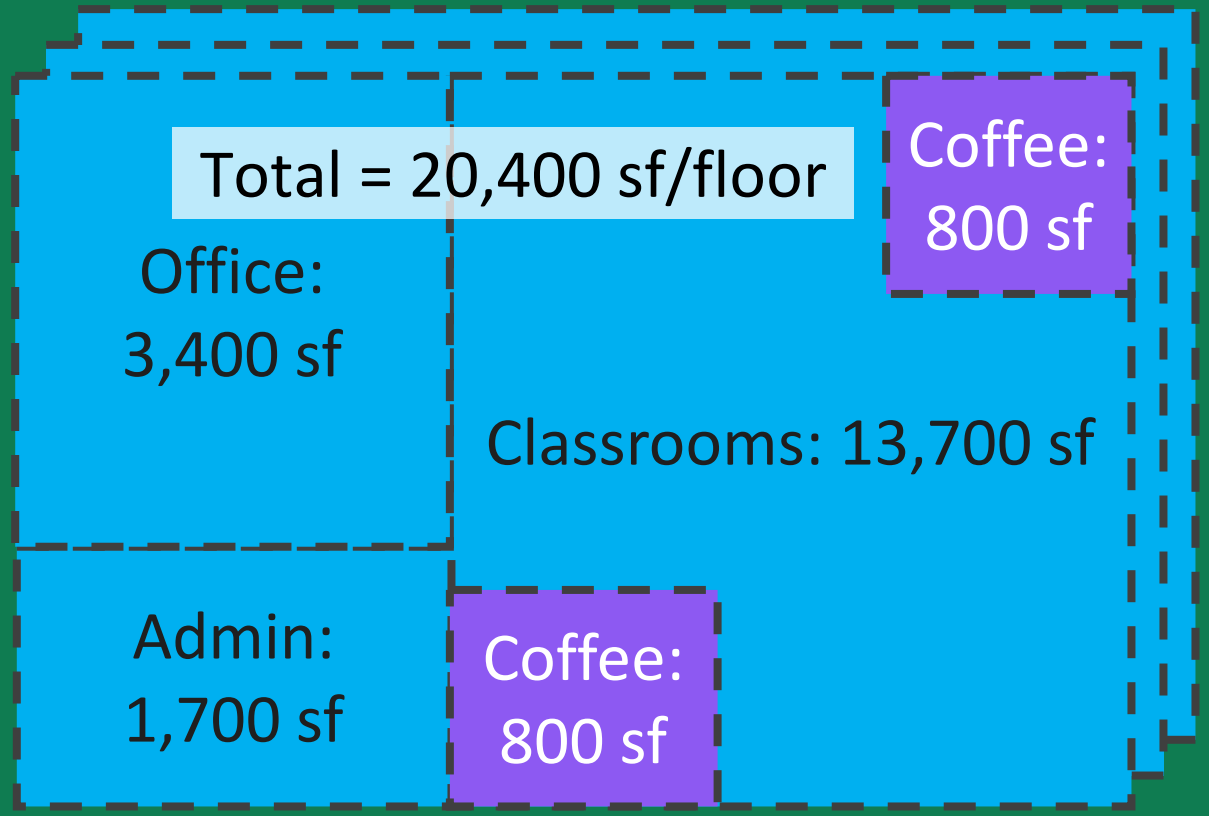


- 3-story building on college campus
- Total building area = 61,200 sf
- 1st floor:
  - (2)-800 sf coffee/snack bars
  - 13,700 sf of classrooms
  - 1,700 sf admin
  - 3,400 sf offices
- 2nd & 3rd floors: 20,400 sf offices
- NFPA 13 sprinkler required throughout building

Allowable Building Size

IBC 508

Multi-story nonseparated occupancies example cont'd

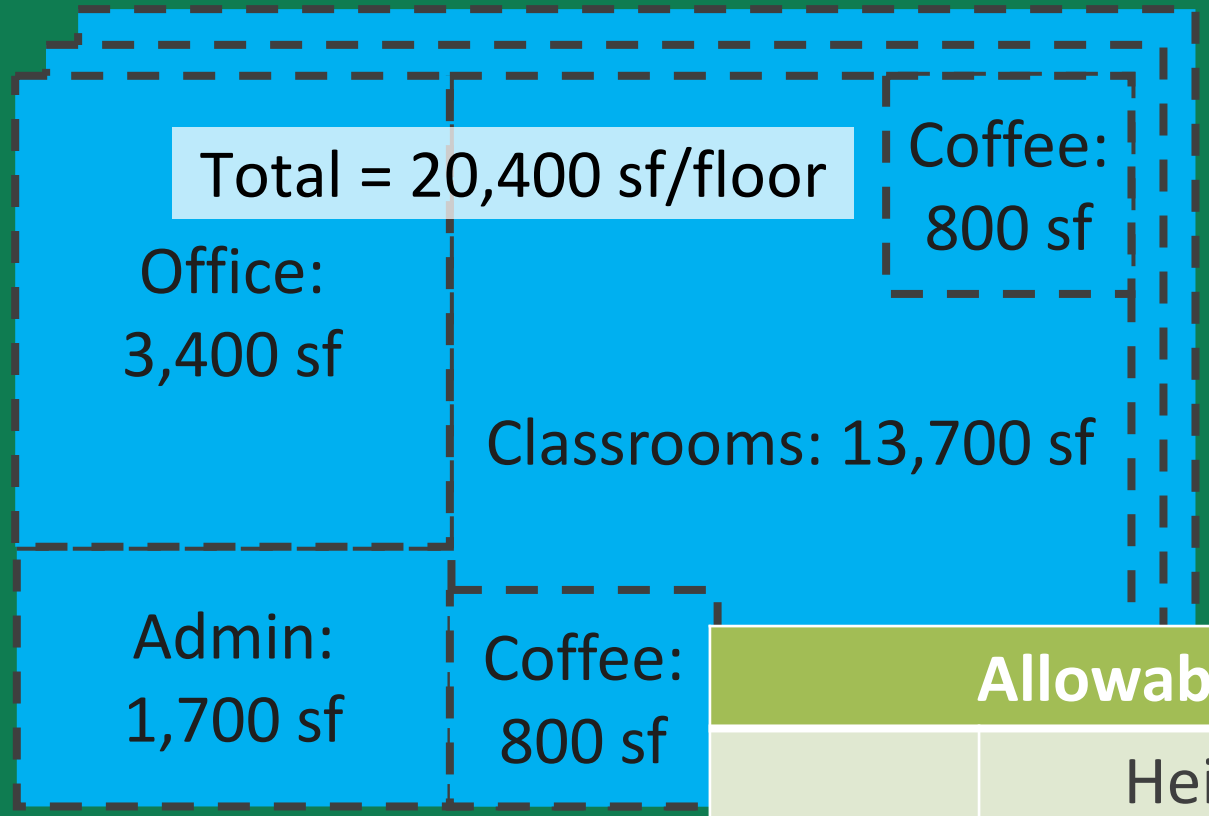


- Classrooms for higher than 12th grade: Group B
- Admin & offices: Group B
- Coffee/snack bar: Group A-2
- May be able to use "small assembly" provision (IBC 303.1.1) – Group B
  - Or may be able to call accessory occupancies – Group B

Allowable Building Size

IBC 508

Multi-story nonseparated occupancies example cont'd



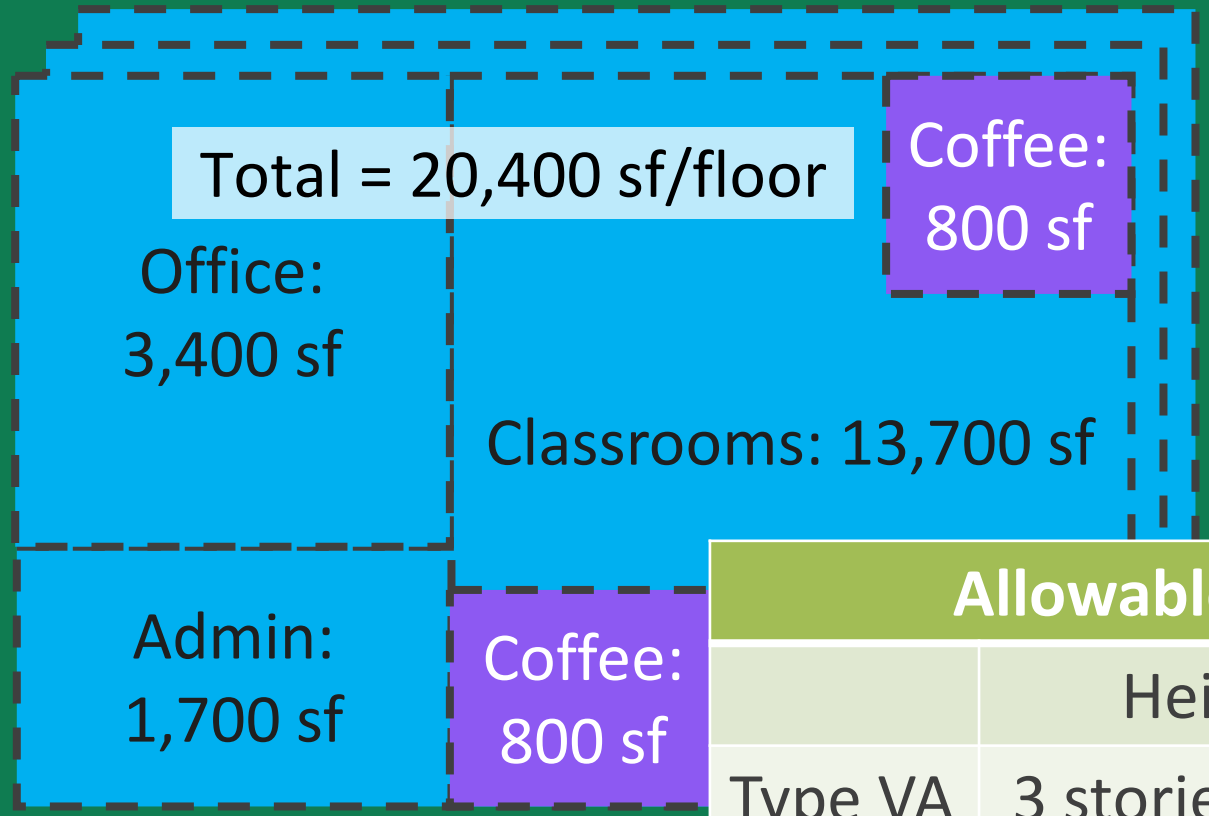
- If coffee/snack areas meet provisions for small assembly spaces or accessory occupancy, entire building is group B and can use **Type VB construction**

Allowable Heights and Areas for Group B		
	Height	Area
Type VB	3 stories; 60 ft	27,000 sf/floor; 81,000 sf total

Allowable Building Size

IBC 508

Multi-story nonseparated occupancies example cont'd



- If coffee/snack areas *don't* meet provisions for small assembly spaces, they are group A-2.
- **Use non-separated occupancies, Type VA construction**
- Group B OK per previous
- Group A-2 per below

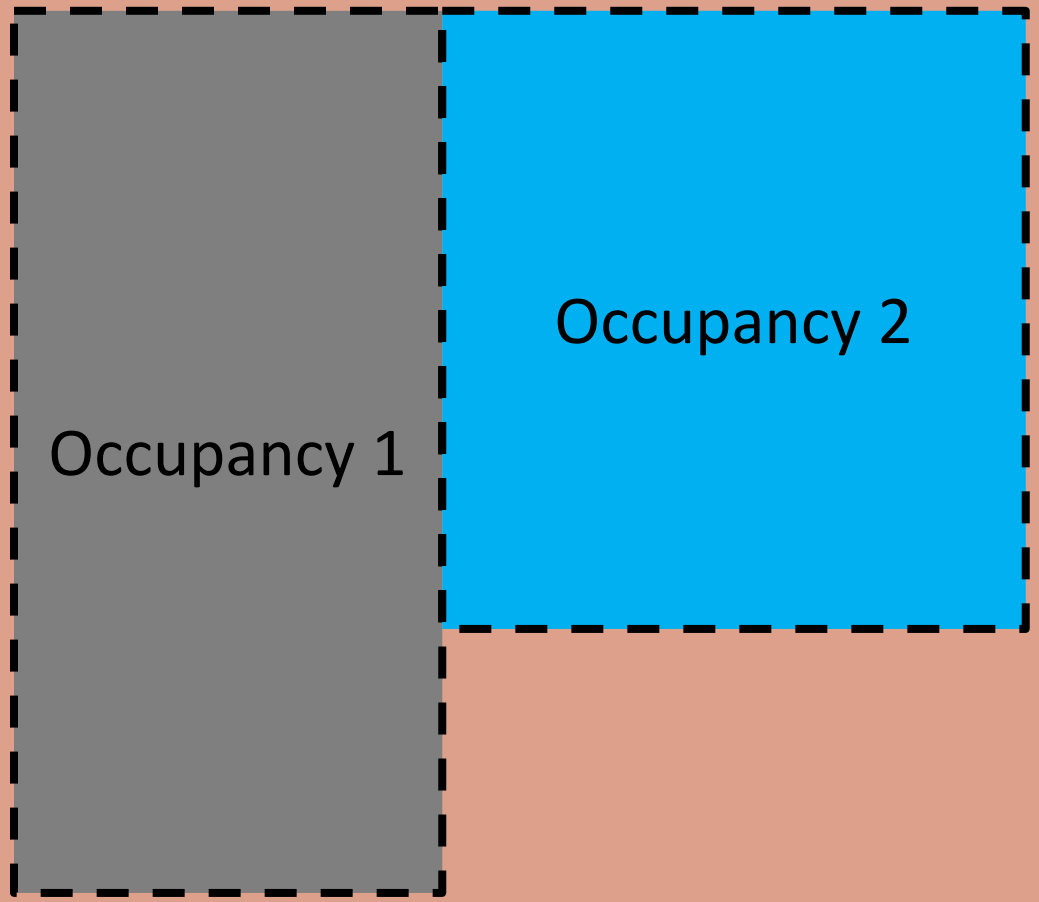
Allowable Heights and Areas for group A-2		
	Height	Area
Type VA	3 stories; 70 ft	34,500 sf/floor; 103,500 sf total
Type VB	~~2 stories; 60 ft~~	~~18,000 sf/floor; 54,000 sf total~~

Separated Occupancies

Allowable Building Size

IBC 508

Separated Occupancies



Requirements of code for each portion based upon occupancy of that portion

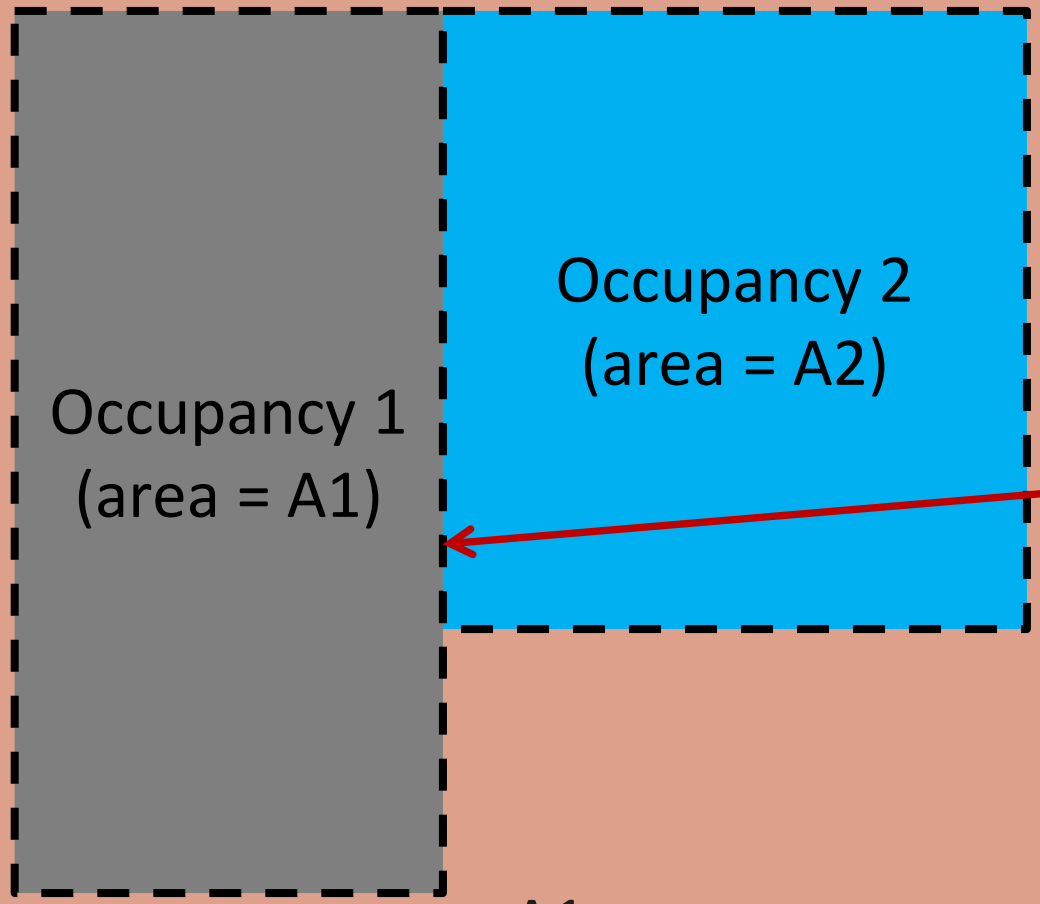
Allowable Height of each occupancy based upon construction type and occupancy

Allowable Area of each story

- Sum of actual area over allowable area of each occupancy ≤ 1.0

Separated Occupancies

IBC 508.4



$$\frac{A1}{\text{Allowable Area for Occupancy 1}} + \frac{A2}{\text{Allowable Area for Occupancy 2}} \leq 1.0$$

Check Performed for each Story.
Separation by Fire Barriers and Horizontal Assemblies

Separated Occupancies

IBC Table 508.4

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	
	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
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N
H-1	—	—	—	—	—	—	—	—	—	—	—	—
H-2	—	—	—	—	—	—	—	—	—	—	—	—
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—
H-5	—	—	—	—	—	—	—	—	—	—	—	—

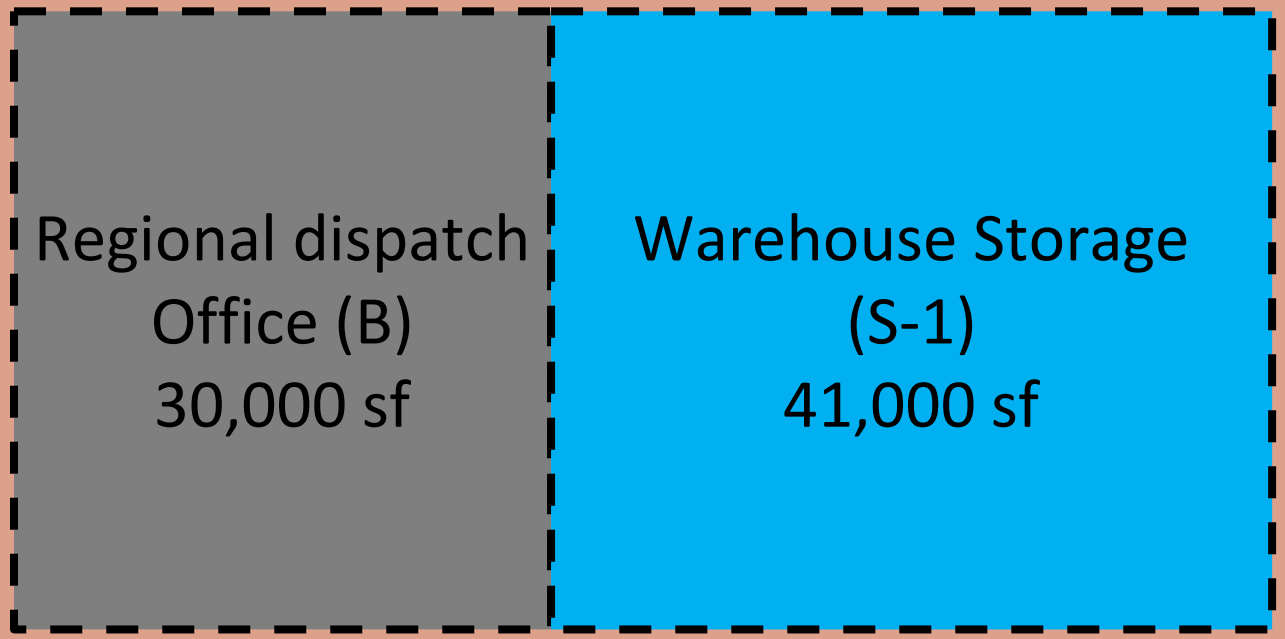
Separation accomplished with:
Walls: fire barriers (IBC 707)
Floors: horizontal assemblies (IBC 711)

S = Sprinklered
NS = No Sprinkler
NP = Not Permitted
N = No Separation Required

Separated Occupancies

IBC 508.4

Separated occupancies example

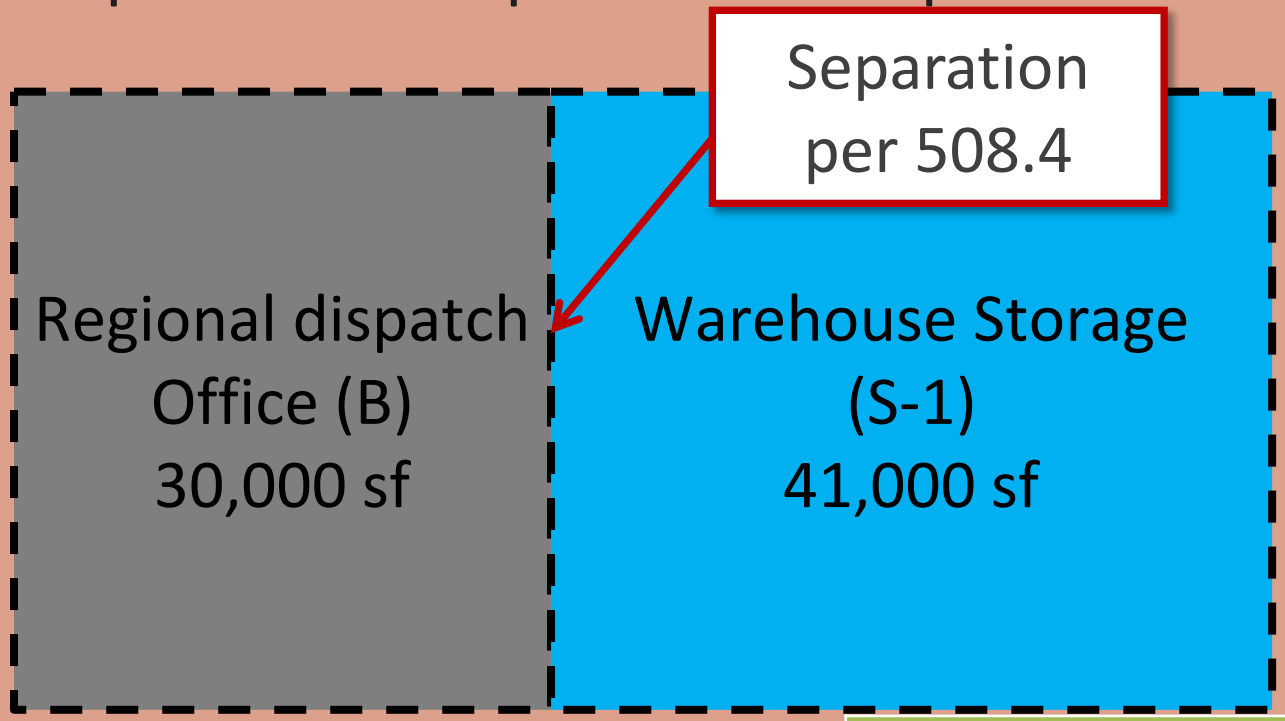


- 1 story building
- Total building area = 71,000 sf
- IBC section 903 does not require an automatic sprinkler in group B buildings but it does for S-1 buildings with fire area > 12,000 sf (903.2.9)
- NFPA 13 sprinkler required throughout building

Allowable Building Size

IBC 508

Separated occupancies example cont'd



Construction type options

- VB: 30,000/36,000 + 41,000/36,000 = 1.97 > 1.0 inadequate
- VA: 30,000/72,000 + 41,000/56,000 = 1.15 > 1.0 inadequate
- IIIB: 30,000/76,000 + 41,000/70,000 = 0.98 < 1.0 ok. **Use type IIIB**

Assumptions:
NFPA 13 sprinkler throughout
No frontage increase.

Allowable 1-Story Building Area (Table 506.2)				
	IIIA	IIIB	VA	VB
Group B	114,000 sf	76,000 sf	72,000 sf	36,000 sf
Group S-1	104,000 sf	70,000 sf	56,000 sf	36,000 sf

Separated Occupancies

IBC Table 508.4

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	
	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
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N
H-1	—	—	—	—	—	—	—	—	—	—	—	—
H-2	—	—	—	—	—	—	—	—	—	—	—	—
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—
H-5	—	—	—	—	—	—	—	—	—	—	—	—

NP = Not Permitted

N = No Separation Required

For this example, no separation required

Separation accomplished with:

Walls: fire barriers (IBC 707)

Floors: horizontal assemblies (IBC 711)

Separated Occupancies

IBC 508.4

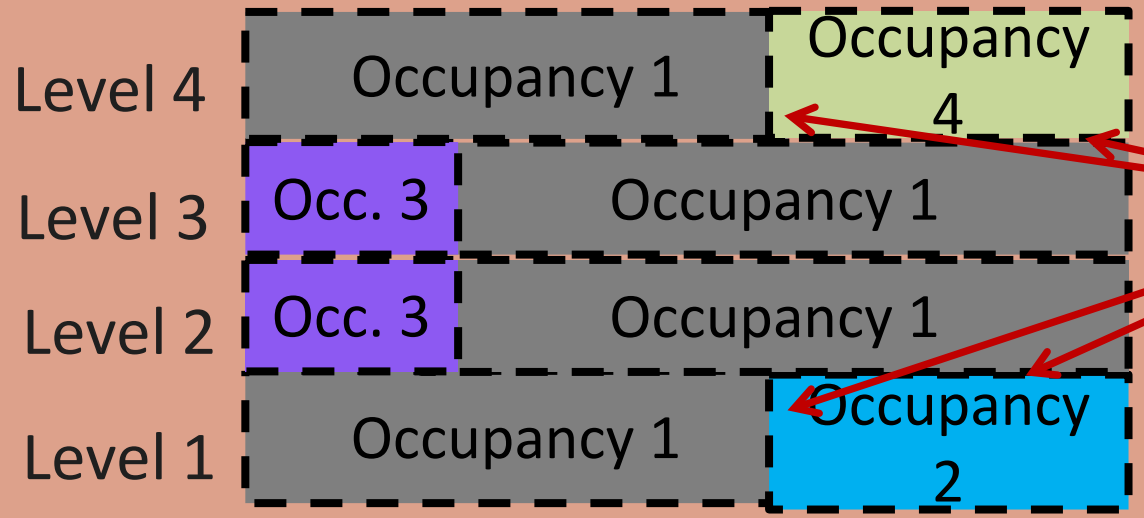
Image credit: CUBE 3 Studio LLC & Rixon Photography

Multi-story separated occupancy buildings

Separated Occupancies

IBC 506.2.4 & 508.4

Multi-story separated occupancy buildings



Separation Per Table 508.4

Also btwn occ. 1 & occ. 3

Elevation view

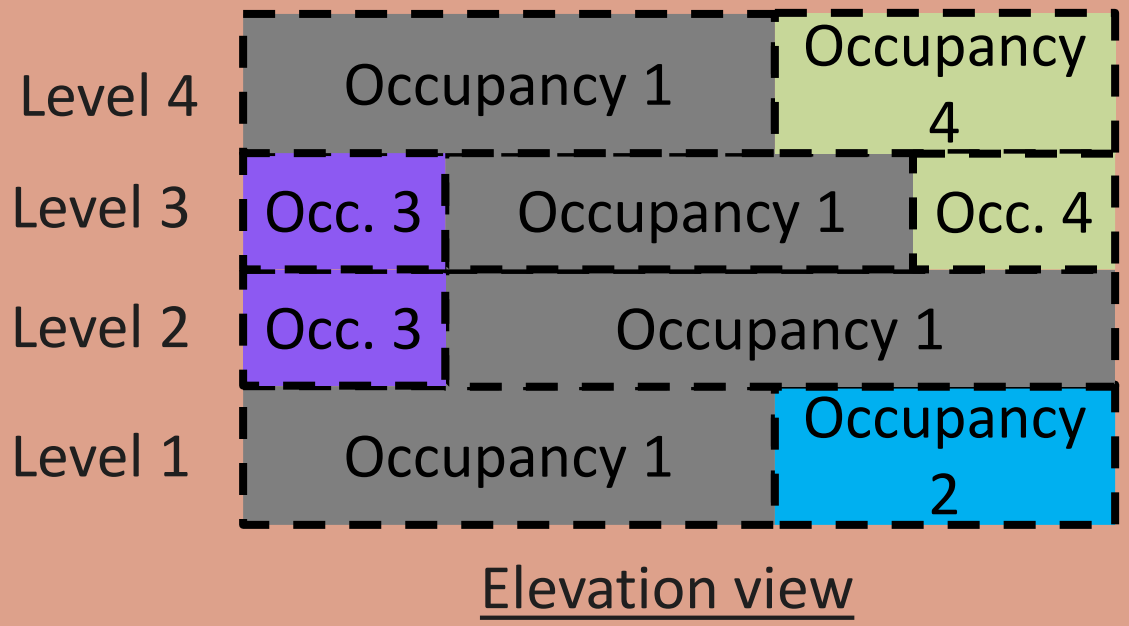
sum of ratios of actual area/allowable area for all occupancies per floor:

≤ 1.0 for 1 story building
≤ 2.0 for 2 story building
≤ 3.0 for 3 or more story building
No floor can have a ratio > 1.0

Separated Occupancies

IBC 508.4

Multi-story separated occupancy example



Elevation view

- 4 story building
- Total building area = 120,000 SF
- Occupancy 1 = apartments (R-2)
- Occupancy 2 = retail (M)
- Occupancy 3 = restaurant (A-2)
- Occupancy 4 = professional offices (B)
- IBC section 903.2.8 requires buildings containing group R fire areas to be sprinklered throughout the building
- Provide NFPA 13 sprinkler throughout building

Separated Occupancies

IBC 508.4

Multi-story separated occupancy example

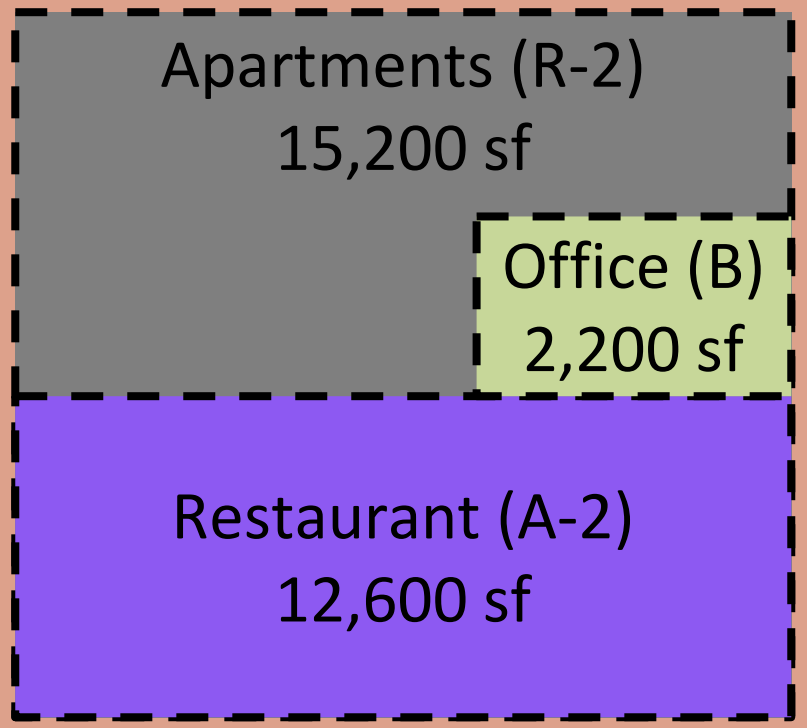
Level 1 floor plan

Level 2 floor plan

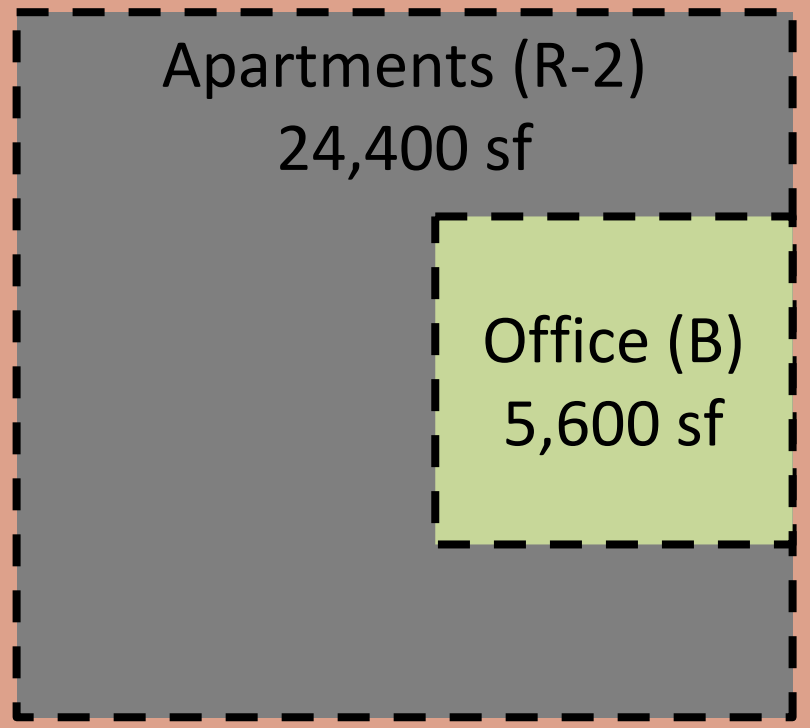
Separated Occupancies

IBC 508.4

Multi-story separated occupancy example



Level 3 floor plan



Level 4 floor plan

Separated Occupancies

IBC 504

Multi-story separated occupancy example

Allowable floor Area / # of stories (from tables 504.4 and 506.2)				
	IIIA	IIIB	VA	VB
Group A-2	42,000 sf / 4	28,500 sf / 3	34,500 sf / 3	18,000 sf / 2
Group B	85,500 sf / 6	57,000 sf / 4	54,000 sf / 4	27,000 sf / 3
Group M	55,500 sf / 5	37,500 sf / 3	42,000 sf / 4	27,000 sf / 2
Group R-2	72,000 sf / 5	48,000 sf / 5	36,000 sf / 4	21,000 sf / 3

With full NFPA 13 sprinkler increases but no frontage increase

Separated Occupancies

IBC 508.4

Multi-story separated occupancy example

Level 1 floor plan

Try construction type VA:
VA: 21,000/36,000 +
9,000/42,000 = 0.80

Allowable height & stories:
R-2: 70 ft, 4 stories - ok
M: 70 ft, 4 stories - ok

Separated Occupancies

IBC 508.4

Multi-story separated occupancy example

Level 2 floor plan

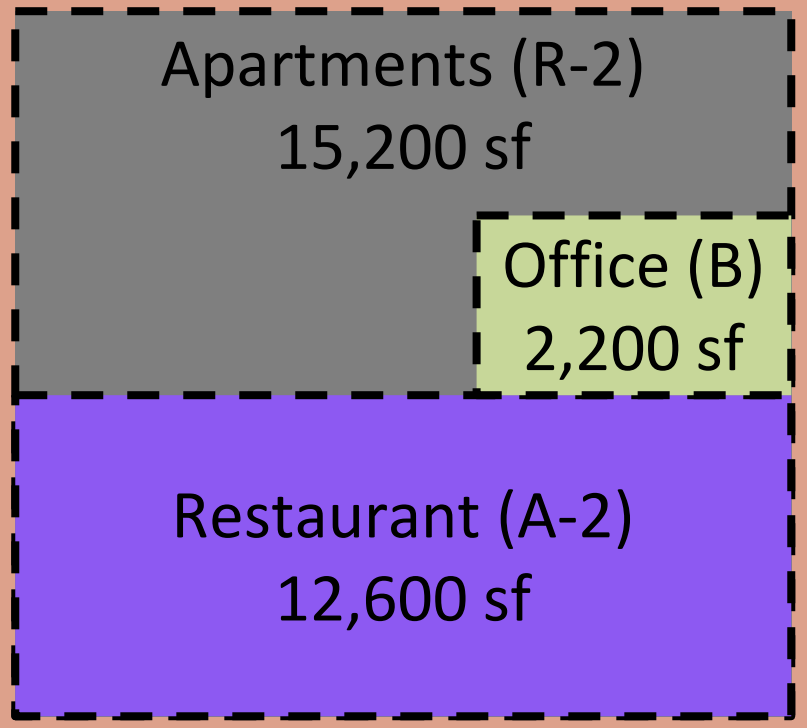
Try construction type VA:
VA: 17,400/36,000 +
12,600/34,500 = 0.85

Allowable height & stories:
R-2: 70 ft, 4 stories - ok
A-2: 70 ft, 3 stories - ok

Separated Occupancies

IBC 508.4

Multi-story separated occupancy example



Level 3 floor plan

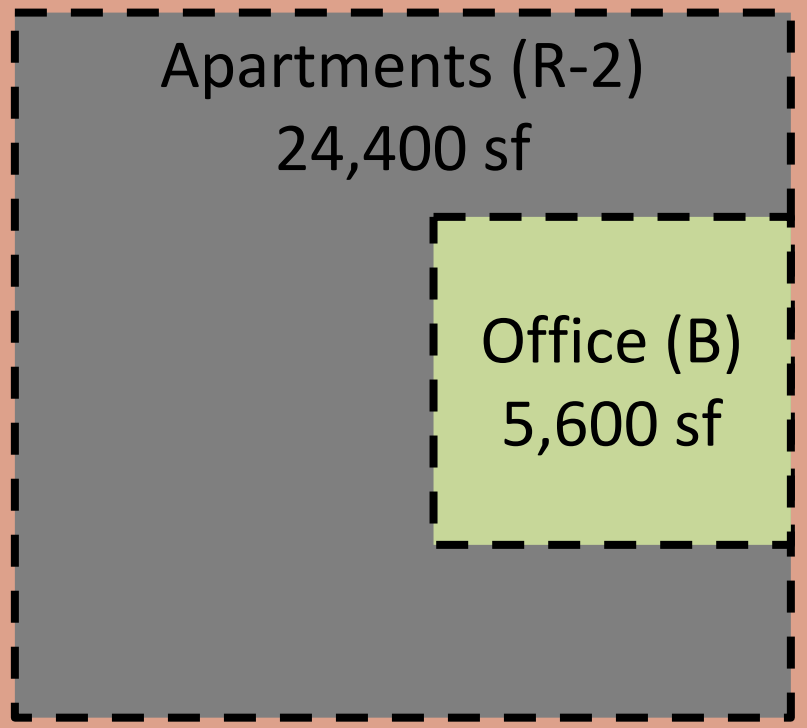
Try construction type VA:
VA: 15,200/36,000 +
12,600/34,500 +
2,200/54,000 = 0.83

Allowable height & stories:
R-2: 70 ft, 4 stories - ok
A-2: 70 ft, 3 stories - ok
B: 70 ft, 4 stories - ok

Separated Occupancies

IBC 508.4

Multi-story separated occupancy example



Level 4 floor plan

Try construction type VA:

VA: 24,400/36,000 +
5,600/54,000 = 0.78

Allowable height & stories:

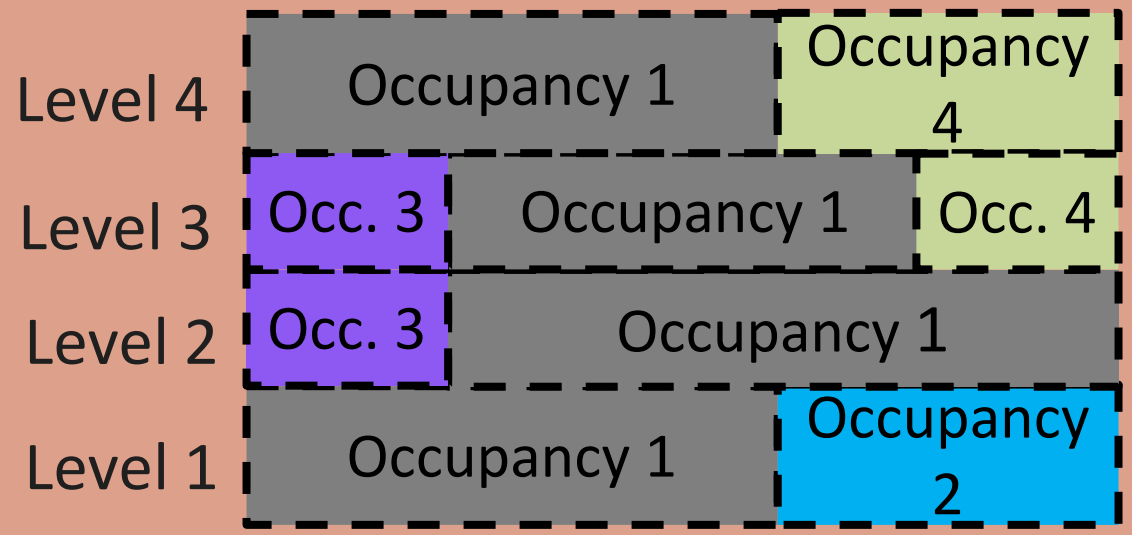
R-2: 70 ft, 4 stories - ok

B: 70 ft, 4 stories - ok

Separated Occupancies

IBC 508.4

Multi-story separated occupancy example



Elevation view

Sum of ratios of actual area/allowable area for all occupancies per floor:

0.78 + 0.83 + 0.85 + 0.80 = 3.26 > 3.0

inadequate; type VA can't be used

Use type IIIB

Separated Occupancies

IBC Table 508.4

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	
	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
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N
H-1	—	—	—	—	—	—	—	—	—	—	—	—
H-2	—	—	—	—	—	—	—	—	—	—	—	—
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—
H-5	—	—	—	—	—	—	—	—	—	—	—	—

NP = Not Permitted,
N = No Separation Required

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

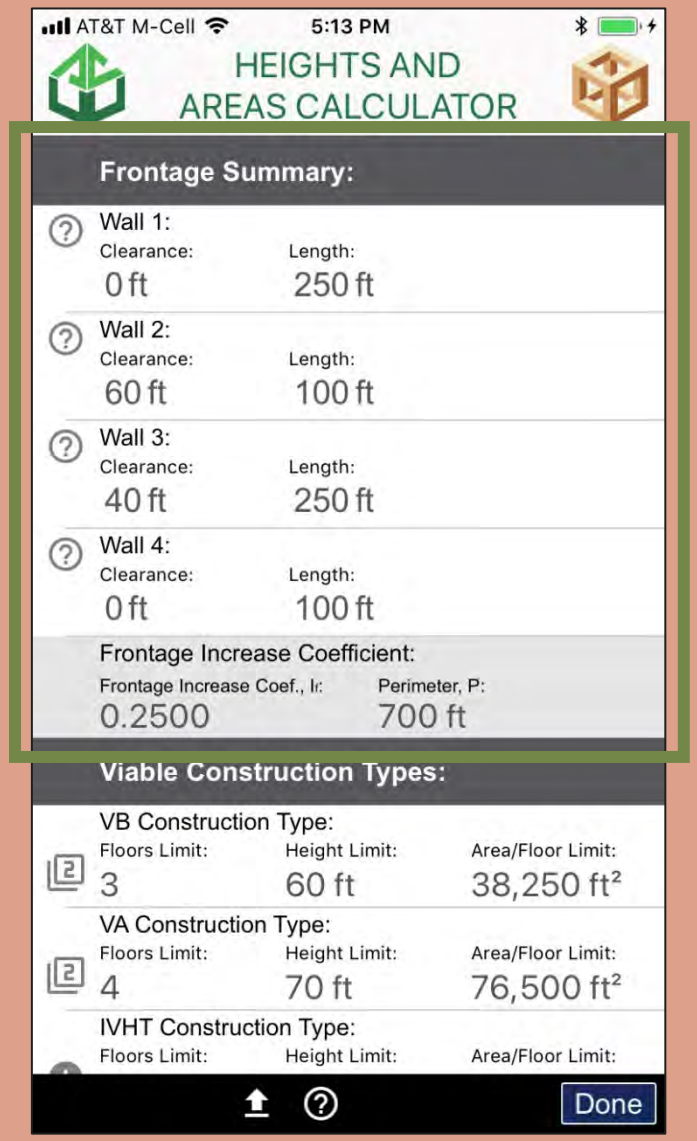
A-2 to M: 1 hr floor

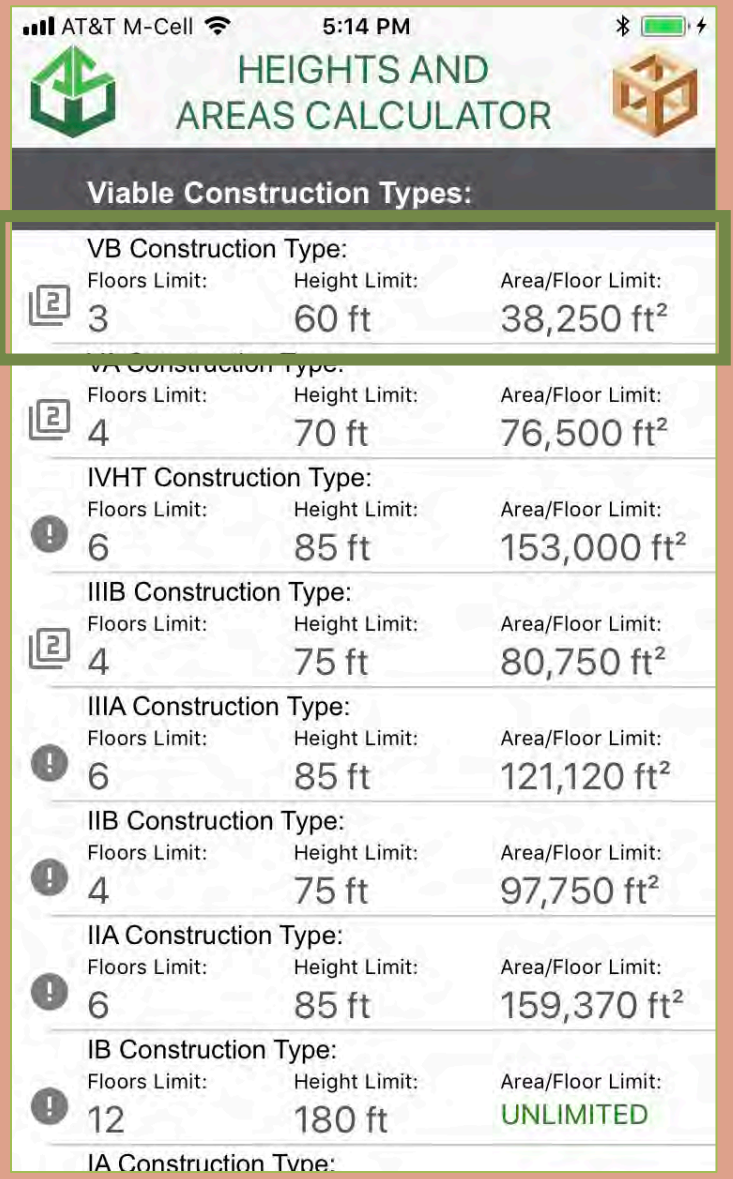
Allowable Building Size

Heights and areas calculator – free tool

http://www.woodworks.org/design-and-tools/design-tools/online-calculators/

Handles Separated Occupancies
Non-Separated Occupancies (Check “both”)





Sprinkler Requirements

IBC 903.2

Mixed use sprinkler thresholds

Consider implications of non-separated occupancies on sprinkler thresholds

Fire area thresholds for NFPA 13 sprinkler requirements (per IBC 903):

- Group A-2: 5,000 sf
- Group B: none (except in ambulatory care facilities)
- Group M: 12,000 sf
- Group R: always required

Sprinkler Thresholds

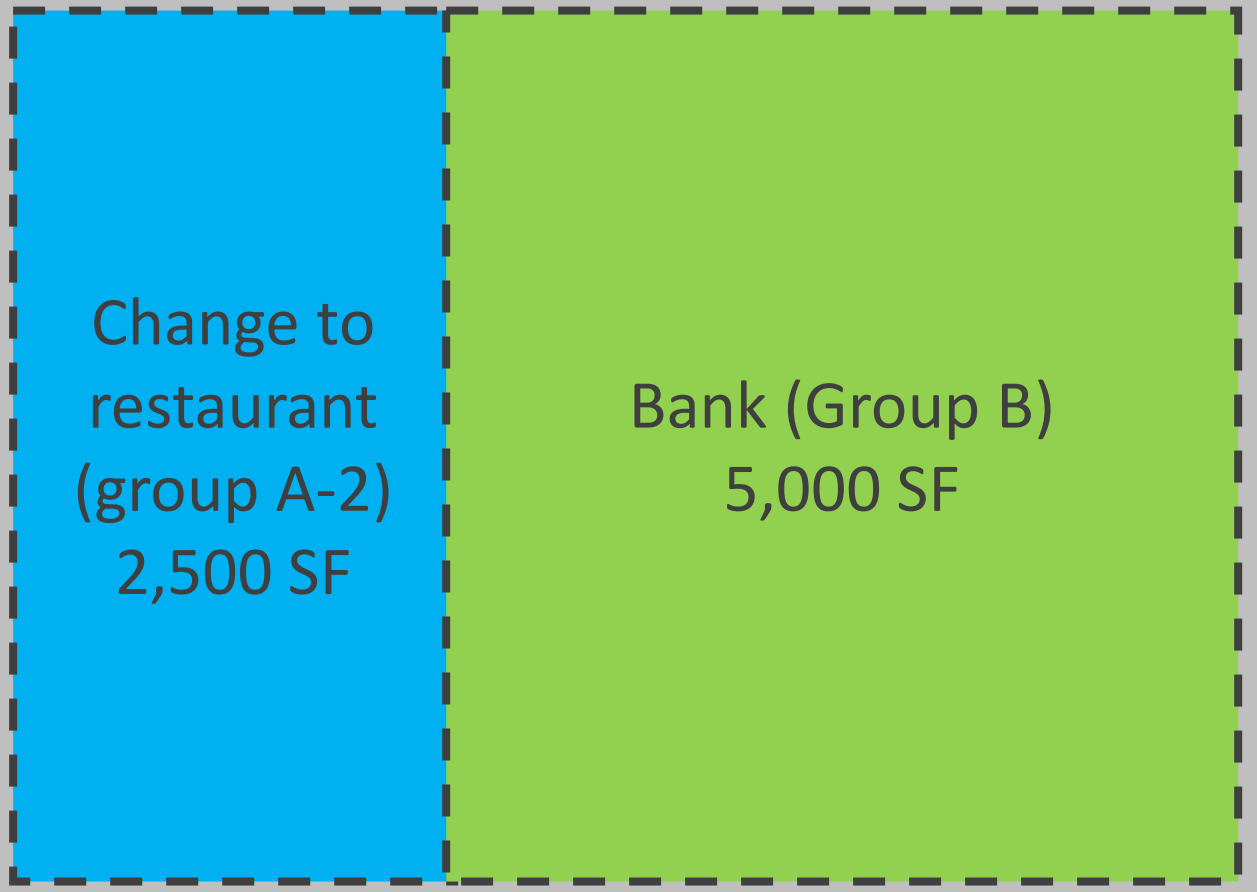
New 7,500 SF Building

- 2,500 SF Print Shop
- 5,000 SF Bank
- All Group B Occupancy
- No sprinkler req'd per 903

Use nonseparated, type VB construction (allow. = 9,000 SF)

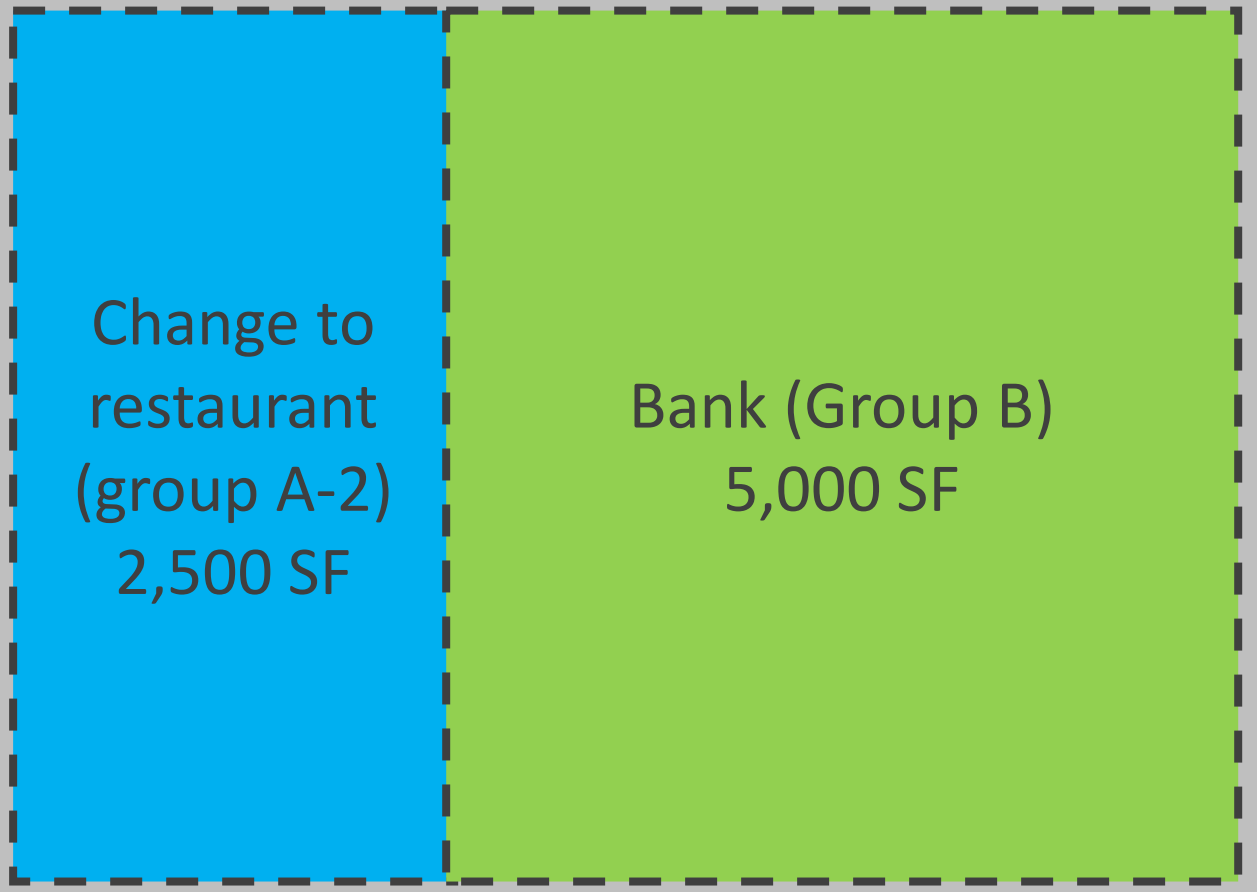
Sprinkler Thresholds

- Allow. For Group A-2, VB = 6,000 SF but adequate frontage exists to make work as nonseparated (Table 506.2)
- 903.2.1.2 requires sprinklers in group A-2 if fire area > 5,000 SF

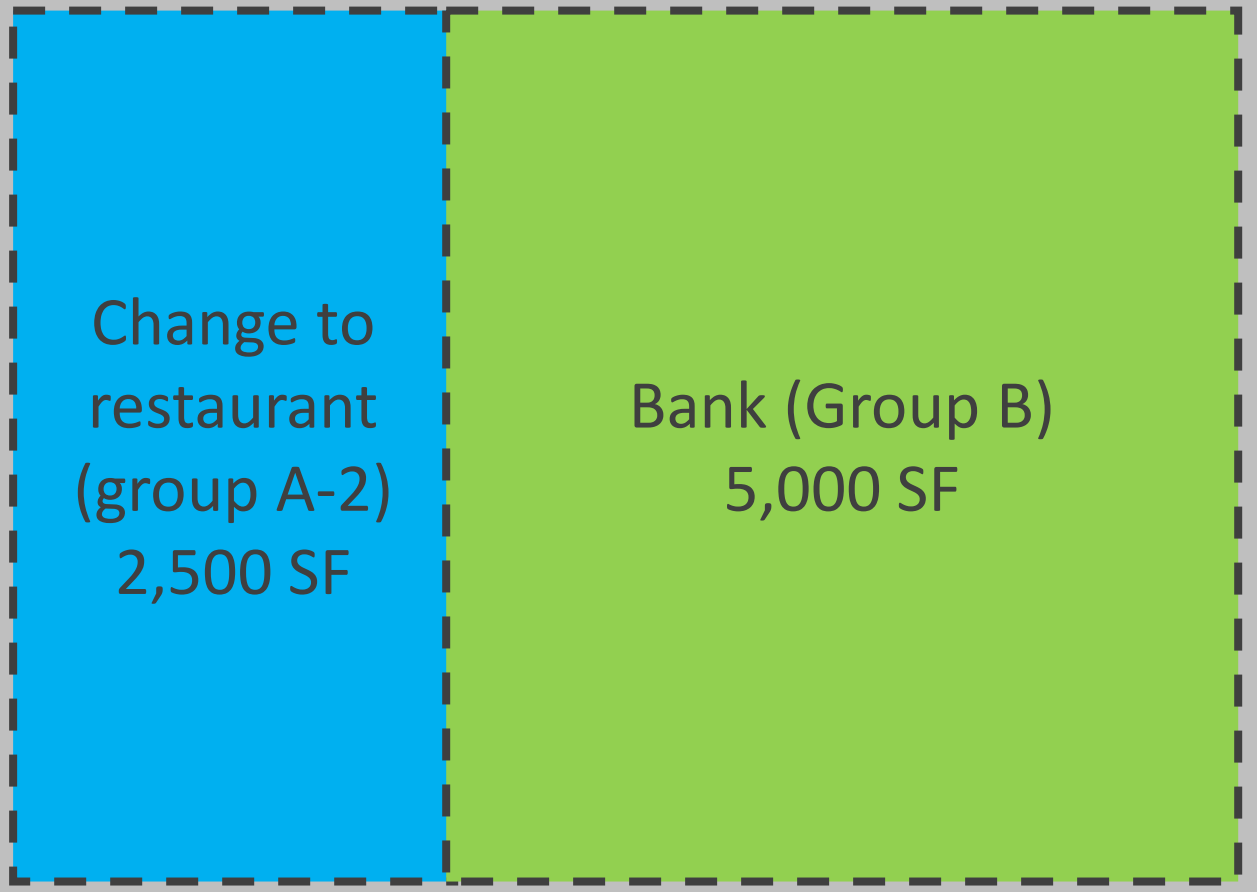


Sprinkler Thresholds

- Even though <u>area</u> of A-2 is only 2,500 SF, <u>fire area</u> is 7,500 SF (entire building)
- Fire area is bounded by exterior walls, fire walls or fire barriers (IBC 202)



Sprinkler Thresholds



Changing construction type doesn't solve this.

Options:

1. Add sprinkler system
2. Create fire barrier somewhere in bldg. to make A-2 fire area < 5,000 SF

Photo credit: Arden photography

Special Provisions

IBC 510

Construction types

IBC 602.1 requires that each building be classified in one of five construction types.

IBC section 510 contains special provisions that in some cases, allow combining multiple construction types in the same building or multiple “buildings” stacked on top of each other or side by side.

Special Provisions

IBC 510.2

Horizontal building separation

Often called the podium provision:

Considered separate buildings above and below for purposes of determining area, number of stories and construction type if:

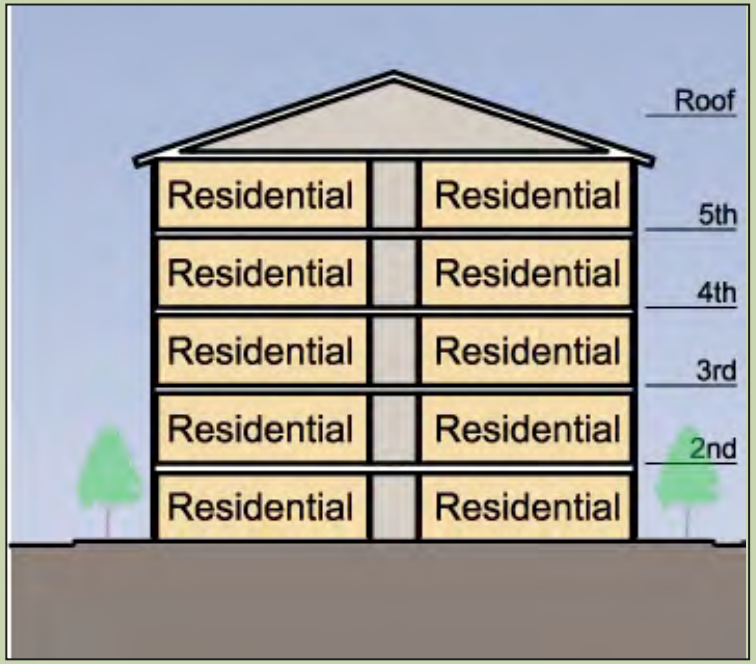
- Overall height in feet is limited to the min of either building as measured from grade.
- 3hr rated horizontal assembly
- Building below is Type 1A with sprinklers

Occupancy restrictions above and below

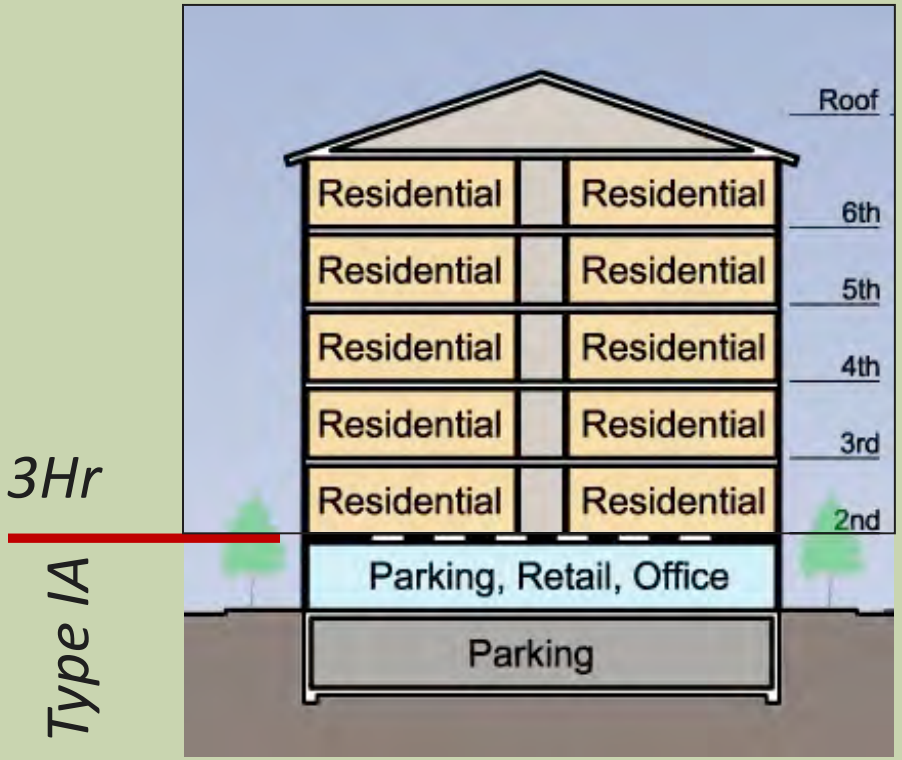
Special Provisions

IBC 510.2

Horizontal building separation



5 story Type III Building

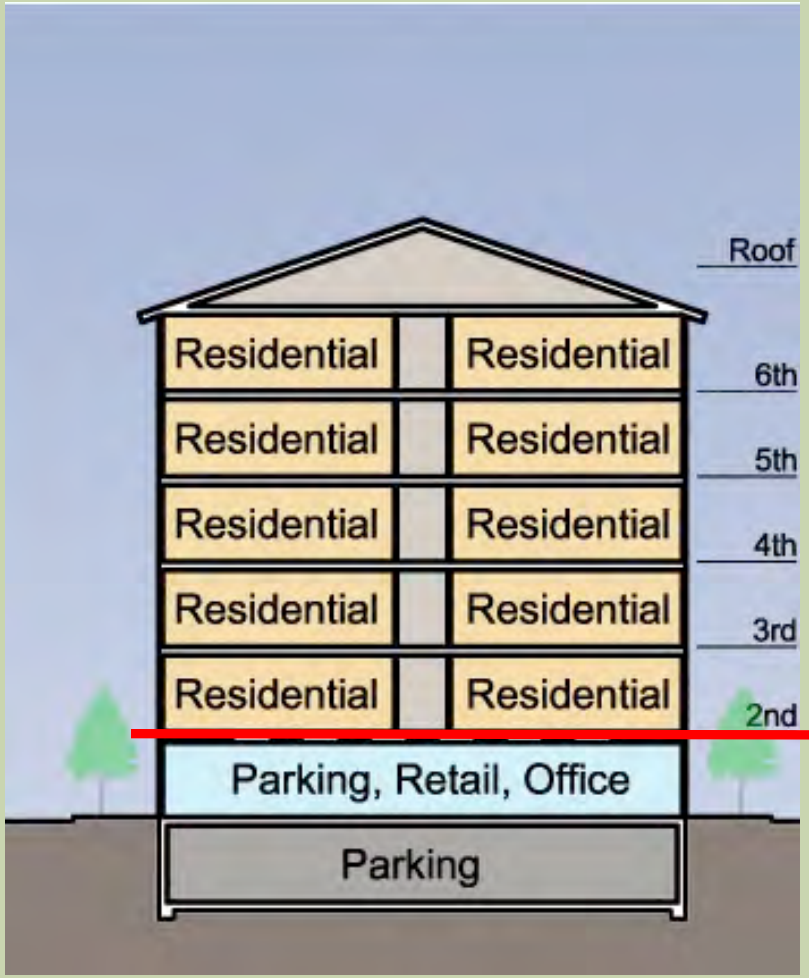


5 story Type III Building
on top of a Type IA Podium

Increases allowable stories… not allowable building height

Special Provisions

IBC 510.2



IBC Provisions for Mixed-Use podium have been evolving.

IBC	2006	2009	2012	2015	2018
Section	509.2	509.2	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		1 Story	No Restriction	

3Hr

Type IA

2015 IBC allows multiple podium stories above grade

Building Configuration Options

Mixed-use occupancies on 1st floor of some buildings often require longer spans for open areas (parking, retail, assembly, lobbies). Just because some designers choose steel or concrete for these longer spans, this doesn't mean that it has to be a type IA podium. You can use materials of any construction type based on occupancy (IBC 602.1.1)

Special Provisions

IBC 510.4

Parking beneath Group R

- Unique application similar to podium provision but allows more flexibility

Special Provisions

IBC 510.4

Parking beneath Group R

If single story above grade, S-2 parking:

- Type I (enclosed or open) or
- Type IV (open) with entrance at grade.

Group R occupancy above:

- Number of stories is measured from the floor above parking
- Floor separating parking & group R:
  - Same construction type as parking
  - Hourly rating per Table 508.4

Special provisions

IBC 510.7

Open Parking beneath Group A, I, B, M or R

Allows mix of construction types without need for podium:

- Parking level(s) must be open type I, II or IV
- Upper portion: Number of stories & height measured from grade plane
- Floor separating parking & upper occupancies: Hourly rating per table 508.4

Comparison

510.2

- Podium: Multi-story, type IA, must be sprinklered
- Occupancy above: A, B, M, R, or S
- Occupancy podium: Any except H
- No. stories measured above podium.
- Bld'g. hgt. measured above grade.
- Horiz. Assembly: 3-hour required
- Considered as separate buildings

510.4

- If 1-story parking: sprinklered or nonsprinklered
- Occupancy above: R
- Occupancy below: S-2, type 1 open or enclosed, or IV open
- No. stories measured above parking.
- Building. hgt. measured above grade
- Horiz. Assembly: per Table 508.4

510.7

- Podium not req'd., parking can be sprinklered or non-sprinklered
- Occupancy above: A, I, B, M, or R
- Only open parking below, type I, II, or IV
- No. stories and height measured above grade
- Horiz. Assembly: per Table 508.4

Building Configuration Options

Image: Stratos

Example:

5 story building

1st floor: parking

2nd-5th floors residential

Options:

1. 4-story, Type VA over 1 story type IA (podium provision – IBC 510.2)
2. 4 Stories of Type VA over 1 story type IV (open) or type I (IBC 510.4) no ”podium” req’d.
3. 5 stories of Type III (enclosed parking only) sep. or nonsep. occ. (IBC 406.6)

How can parking be incorporated in mixed-use, wood-frame buildings from a construction type perspective?

Accommodating multiple uses on the same site—such as a combination of parking, residences and retail/restaurants—is a common design practice. In multi-story, multi-family wood-frame construction, a common configuration is parking (sometimes mixed with other commercial space) on the first level with three, four or five stories of wood-frame residential construction on top. Many designers are quick to assume that the parking level is required to be non-combustible; however, there are several opportunities for wood framing that can offer significant cost savings.

Code Requirements for Parking Structures

Section 311.3 of the International Building Code (IBC) states that parking garages, open or enclosed, are classified as Group S-2 occupancy while Section 312.1 states that private garages are classified as Group U. As such, there are two significant distinctions to make when designing buildings that have parking areas: whether the parking is private or public and whether it is open or enclosed.

IBC Section 202 defines a private garage as "A building or portion of a building in which motor vehicles used by the tenants of the building or buildings on the premises are stored or kept, without provisions for repairing or servicing such vehicles for profit." Although there are circumstances where the parking areas of a mixed-use building can be classified as private and Group U, the information below is based on public parking garages, which are more common.

IBC Section 406 provides a number of provisions specific to motor-vehicle-related occupancies. Section 406.5 provides requirements for open parking garages, which are discussed in Section 406.5.2 as providing natural ventilation through openings on at least 40% of the garage's perimeter. Section 406.5.1 permits open parking garages to be of Types I, II or IV construction.

http://www.woodworks.org/ask-an-expert/

Enclosed parking garages are covered by IBC mechanical ventilation and NFPA 13 sprinklers per Section 903.2.10. No construction type limitations are given for enclosed parking garages, indicating that wood-frame parking garages of Types III, IV or V construction could be used

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Ask an Expert

Q: When is blocking/bracing within wood-frame walls required? What is considered adequate bracing for wood wall studs in their weak axis?

A: Wood studs used in light-frame wall construction may require horizontally-oriented blocking for a number of reasons—including blocking at shear panel edges, fire blocking, and buckling restraint when subject to axial loads. Structural Blocking Purposes Blocking to Reduce Stud Slenderness Ratio Section 3

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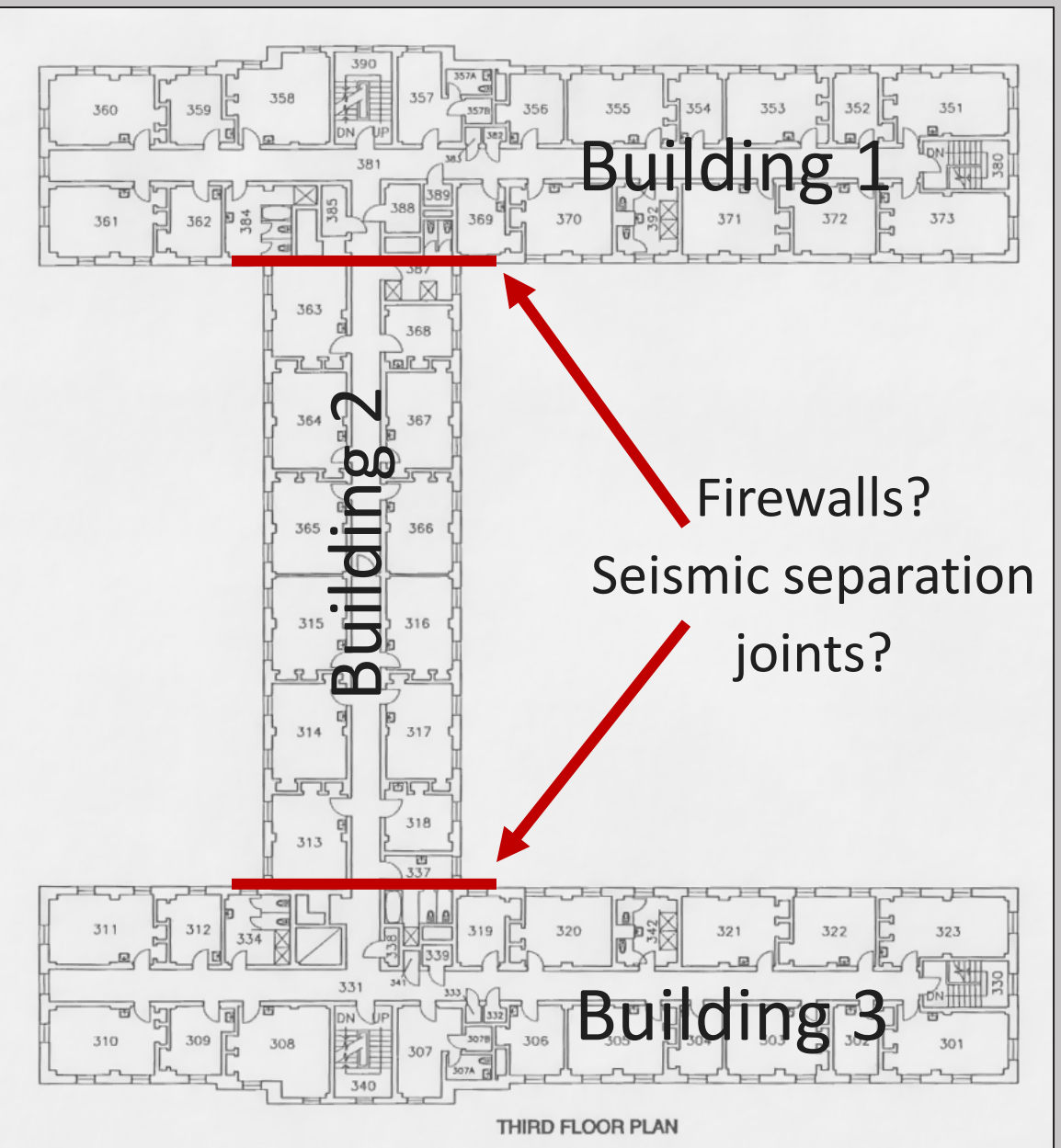
Feature Project

Building Configuration Options



These building configurations may lend themselves well to use of seismic separation joints or firewalls at building intersections.

Minimize length/impact of firewall while maximizing allowable building area may allow lower construction type (i.e. type IIIB instead of IIIA)

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