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WOOD PRODUCTS COUNCIL

Taking the Guesswork out of Mixed Use Building Analysis

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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 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.

FIRE AND LIFE SAFETY

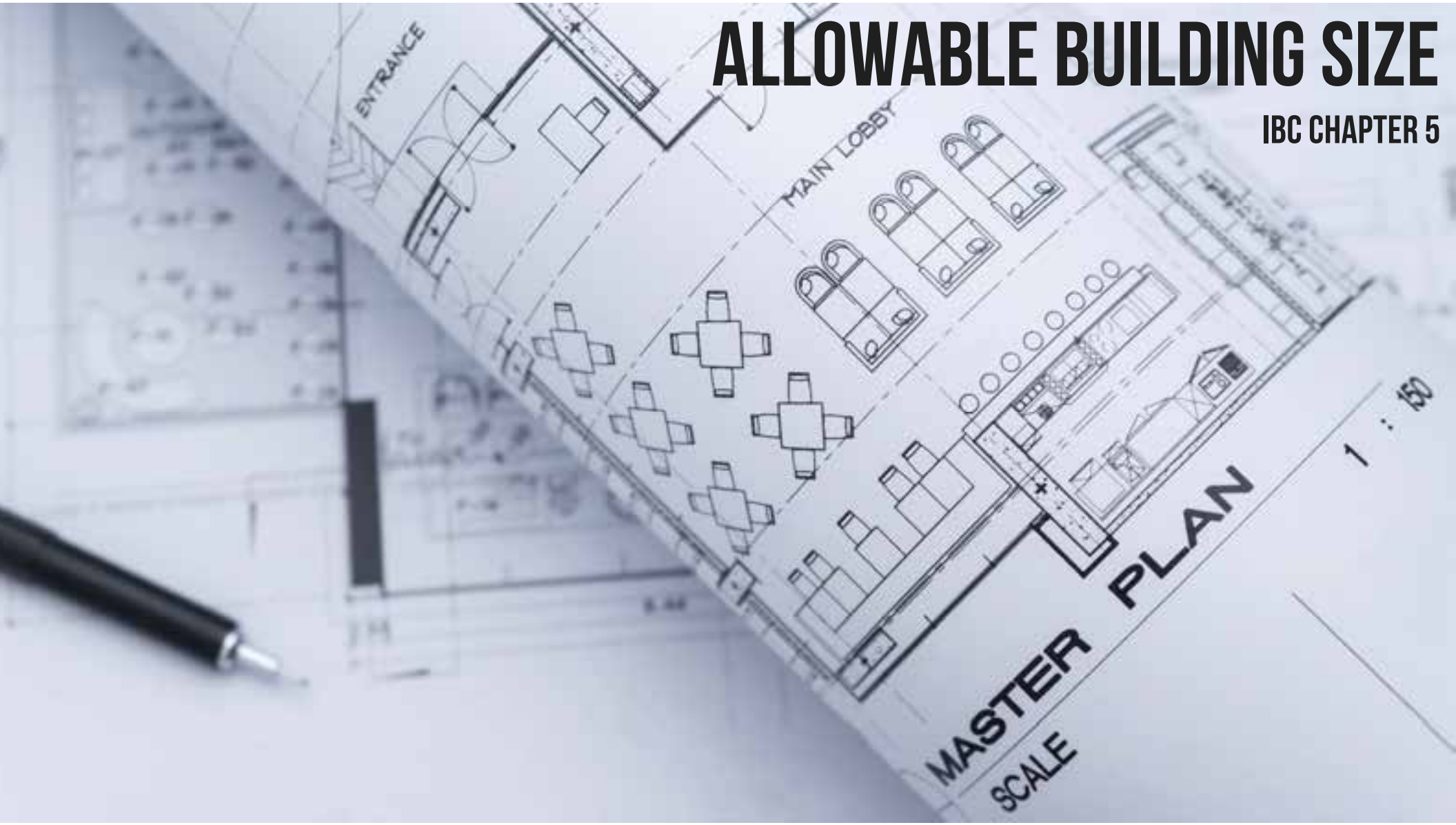
IBC

THE BUILDING CODE:

- CONTROLS BUILDING SIZE
- REGULATES TYPE OF MATERIALS USED
- STIPULATES FIRE RESISTANCE

ALLOWABLE BUILDING SIZE

IBC CHAPTER 5



BUT…

THE CODE STILL ALLOWS FLEXIBILITY IN BUILDING DESIGN, CONFIGURATION, CONSTRUCTION TYPE, MATERIALS AND OTHER CHOICES

MID-RISE VS. HIGH-RISE

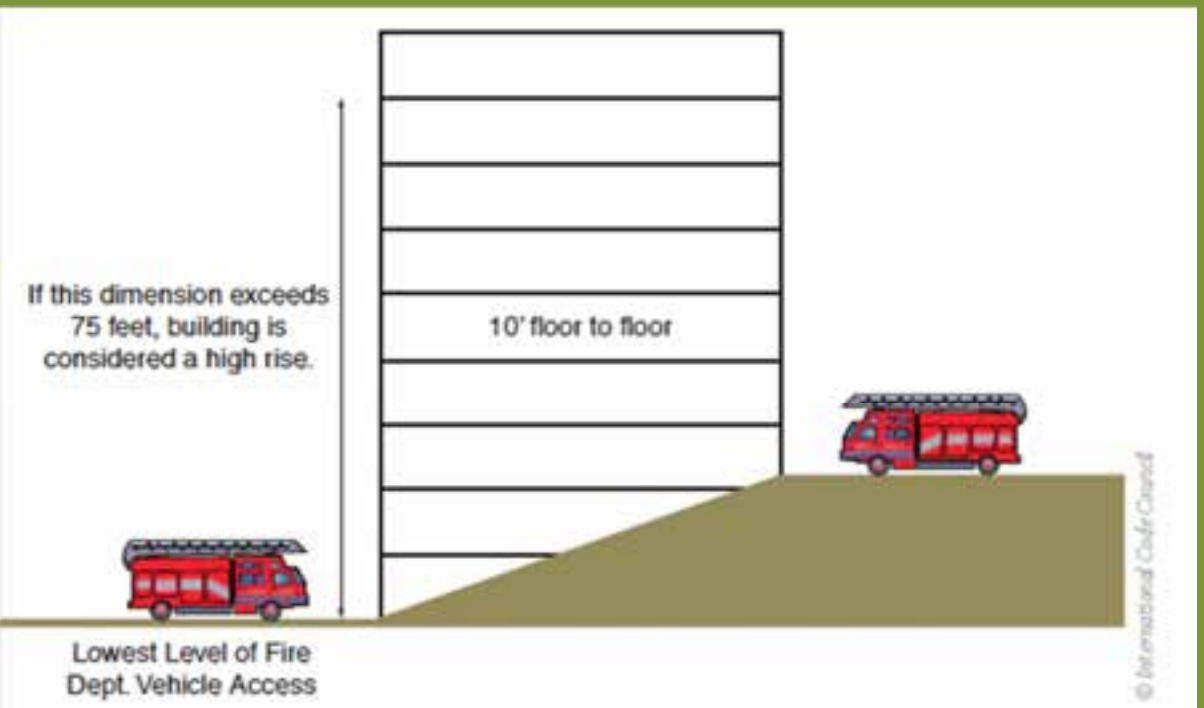


FIGURE 6-6 Determination of high-rise building

IBC 202: HIGH-RISE BUILDING:

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

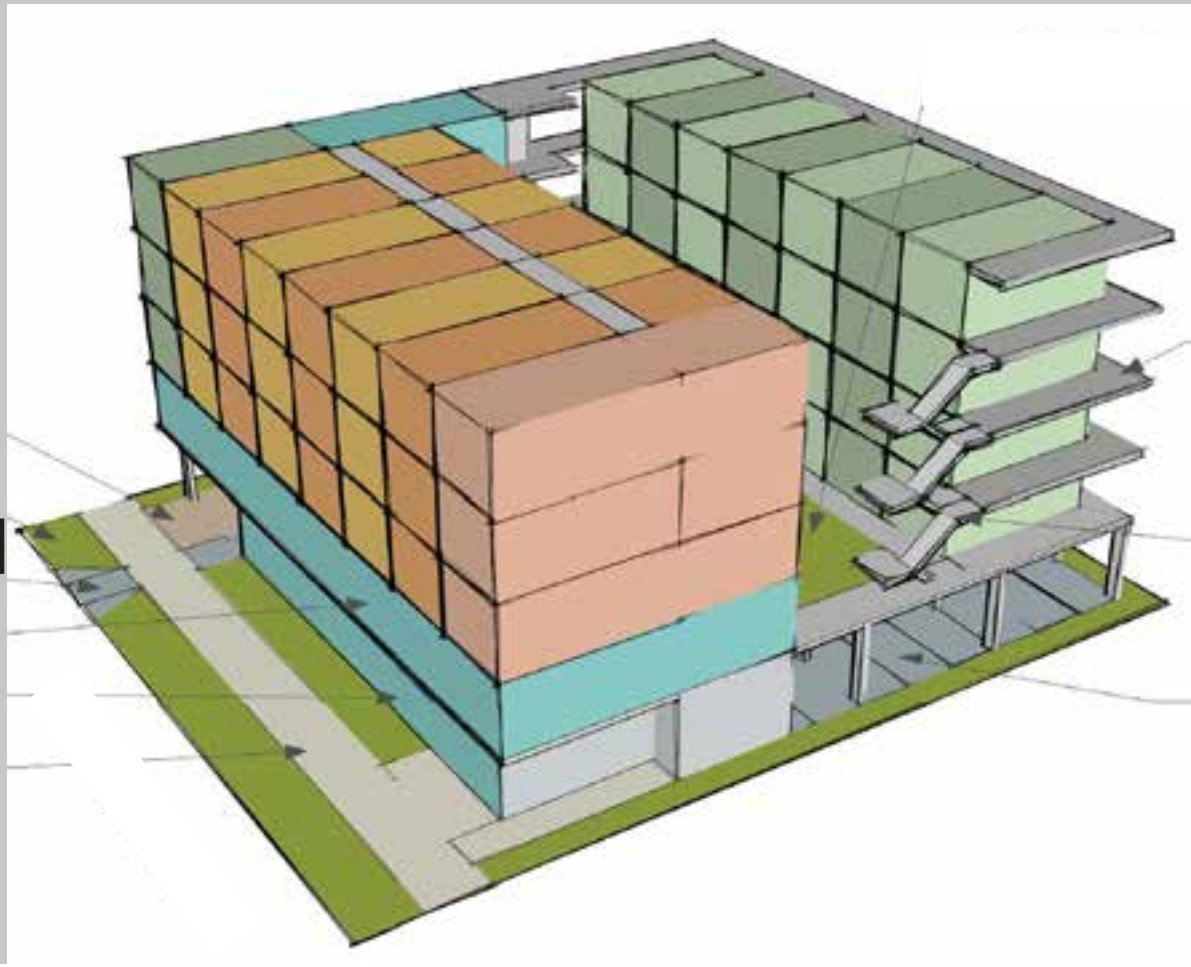
BASE BUILDING SIZE

IBC TABLE 503 (2012 IBC)

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	HEIGHT (feet)	UL	160	65	55	65	55	65	50	40
		STORIES(S) AREA (A)								
A-1	S A	UL UL	5 UL	3 15,500	2 8,500	3 14,000	2 8,500	3 15,000	2 11,500	1 5,500
A-2	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-3	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-4	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-5	S A	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL
B	S A	UL UL	11 UL	5 37,500	3 23,000	5 28,500	3 19,000	5 36,000	3 18,000	2 9,000
M	S A	UL UL	11 UL	4 21,500	2 12,500	4 18,500	2 12,500	4 20,500	3 14,000	1 9,000

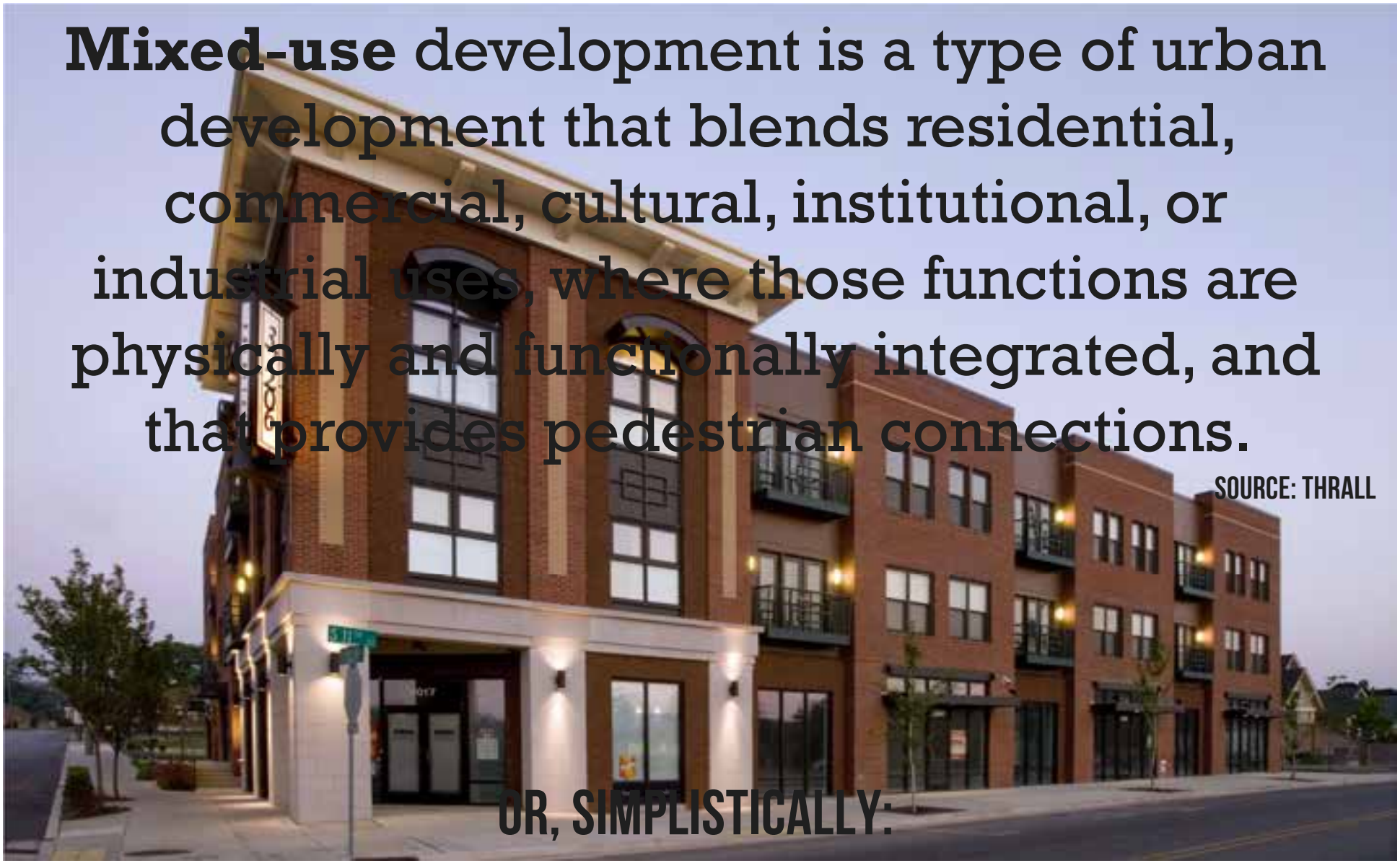
BUILDING CONFIGURATION OPTIONS

THERE ARE MULTIPLE WAYS TO CLASSIFY A BUILDING. CHALLENGE TRADITION AND CONSIDER ALL OPTIONS IN AN EFFORT TO ACHIEVE THE MOST COST EFFECTIVE SOLUTION



MIXED USE ...

PHOTO CREDIT: NICHOLAS WREY COURTESY OF APPLIED ARCHITECTURE INC.

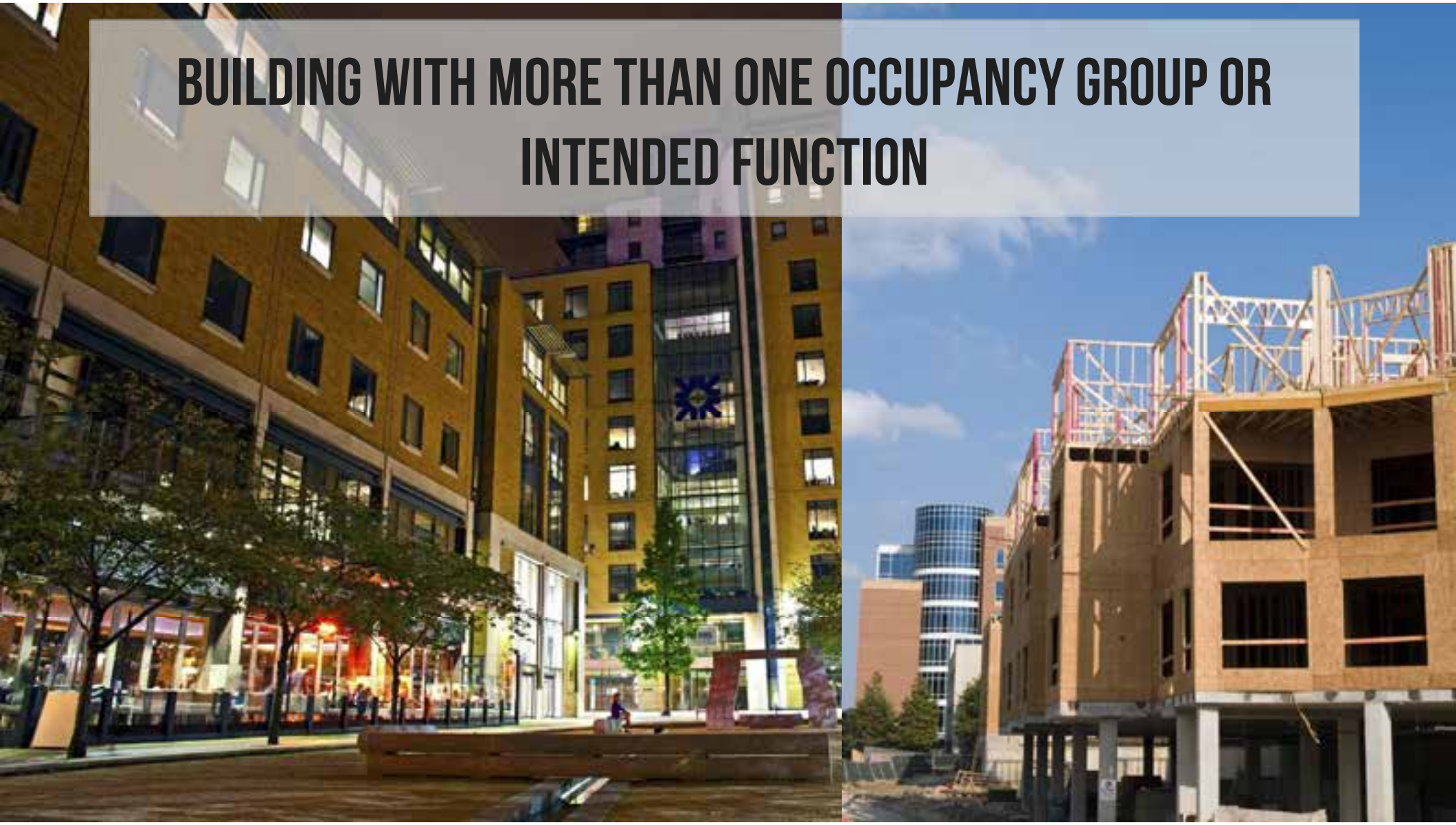


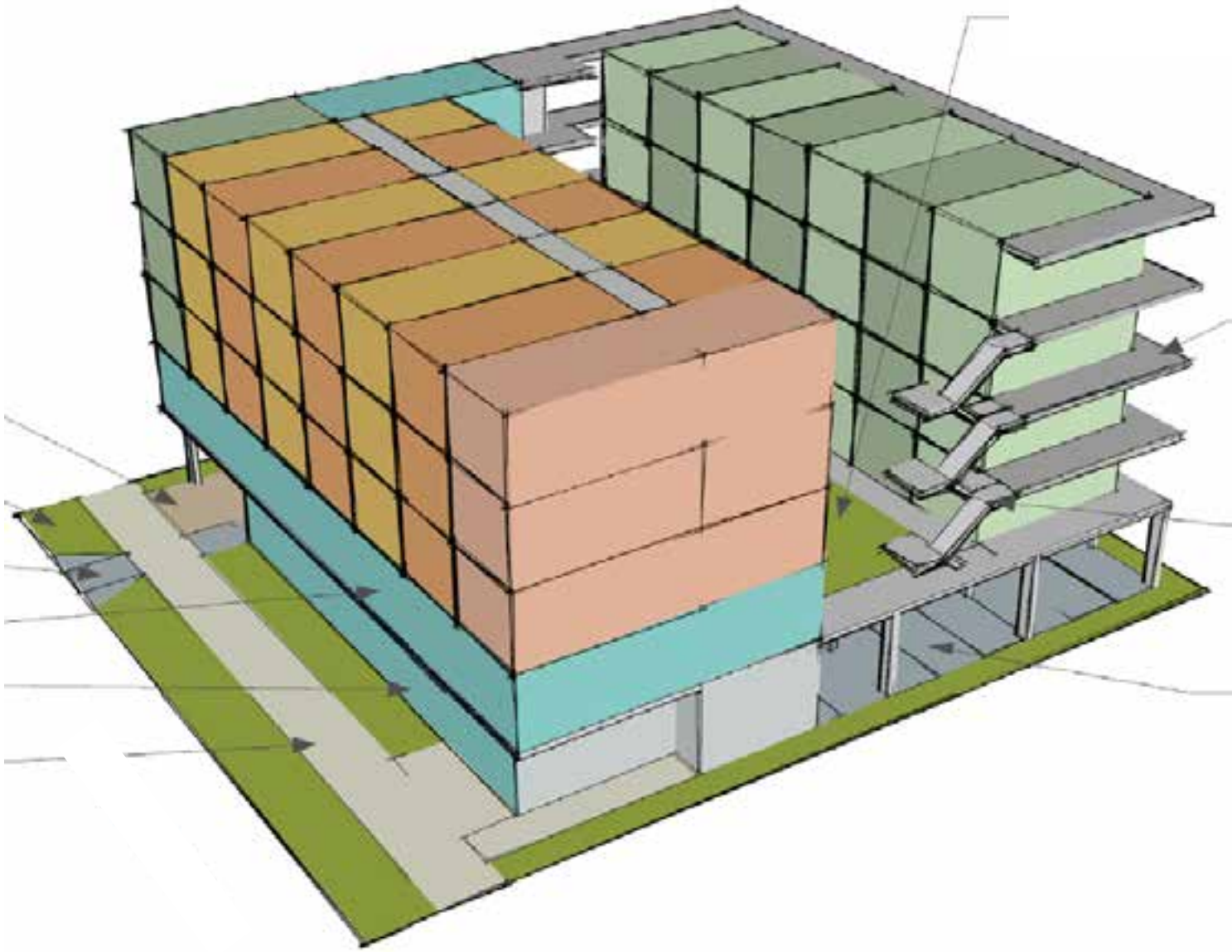
Mixed-use development is a type of urban development that blends residential, commercial, cultural, institutional, or industrial uses, where those functions are physically and functionally integrated, and that provides pedestrian connections.

SOURCE: THRALL

OR, SIMPLISTICALLY:

BUILDING WITH MORE THAN ONE OCCUPANCY GROUP OR INTENDED FUNCTION





BUILDING CONFIGURATION OPTIONS

MANY BUILDINGS UTILIZE A HIGHER CONSTRUCTION TYPE THAN NECESSARY DUE TO TRADITIONAL PRACTICE. THIS CAN HAVE AN IMPACT ON FIRE RATINGS, MATERIALS AND ULTIMATELY COST.

ALLOWABLE BUILDING SIZE

IN LOW- TO MID-RISE BUILDING TYPES, MANY DESIGNERS ACCUSTOMED TO STEEL & CONCRETE DEFAULT TO TYPE II CONSTRUCTION

However, nearly identical building size can be achieved with wood framing in Type IIIA or IIIB

Additionally, through market data analysis, have shown that majority of commercial & multi-family buildings can be type v construction

Why is the construction type selection so important?

BASE BUILDING SIZE

IBC TABLE 503

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	HEIGHT (feet)	UL	160	65	55	65	55	65	50	40
		STORIES(S) AREA (A)								
A-1	S A	UL UL	5 UL	3 15,500	2 8,500	3 14,000	2 8,500	3 15,000	2 11,500	1 5,500
A-2	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-3	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-4	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-5	S A	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL
B	S A	UL UL	11 UL	5 37,500	3 23,000	5 28,500	3 19,000	5 36,000	3 18,000	2 9,000
M	S A	UL UL	11 UL	4 21,500	2 12,500	4 18,500	2 12,500	4 20,500	3 14,000	1 9,000

CONSTRUCTION TYPES

ALLOWABLE BUILDING HEIGHT

IBC 2015 TABLES 504.3 & 504.4

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

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

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-3	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-4	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
E	NS	UL	5	3	2	3	2	3	1	1
	S	UL	6	4	3	4	3	4	2	2

CONSTRUCTION TYPES

ALLOWABLE FLOOR AREA

IBC 2015 TABLE 506.2

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

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-2	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
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

ICC BUILDING VALUATION DATA, M OCCUPANCY BUILDINGS FEBRUARY 2017

CONSTRUCTION TYPE DIFFERENCES

	IIIA	IIIB	IV	VA	VB
EXTERIOR WALL MATERIALS	FRTW	FRTW	FRTW	ANY WOOD	ANY WOOD
EXTERIOR BRNG WALL RATING	2 HR	2 HR	2 HR	1 HR	0 HR
INTERIOR ELEMENTS	ANY WOOD	ANY WOOD	HEAVY TIMBER	ANY WOOD	ANY WOOD
FIRE WALL MATERIALS	NON-COMBUSTIBLE	NON-COMBUSTIBLE	NON-COMBUSTIBLE	ANY	ANY
BUILDING SIZE	USUALLY 2ND LARGEST TYPICALLY SAME # OF STORIES AS IV BUT SMALLER AREA	COMPARABLE TO VA, LARGER IN SOME CASES, SMALLER IN OTHERS	USUALLY LARGEST TYPICALLY SAME # OF STORIES AS IIIA BUT LARGER AREA	COMPARABLE TO IIIB TYPICALLY 1-2 STORIES LESS THAN IIIA AND IV	SMALLEST TYPICALLY 1 STORY LESS THAN VA AND ½ TO 2/3 AREA OF VA

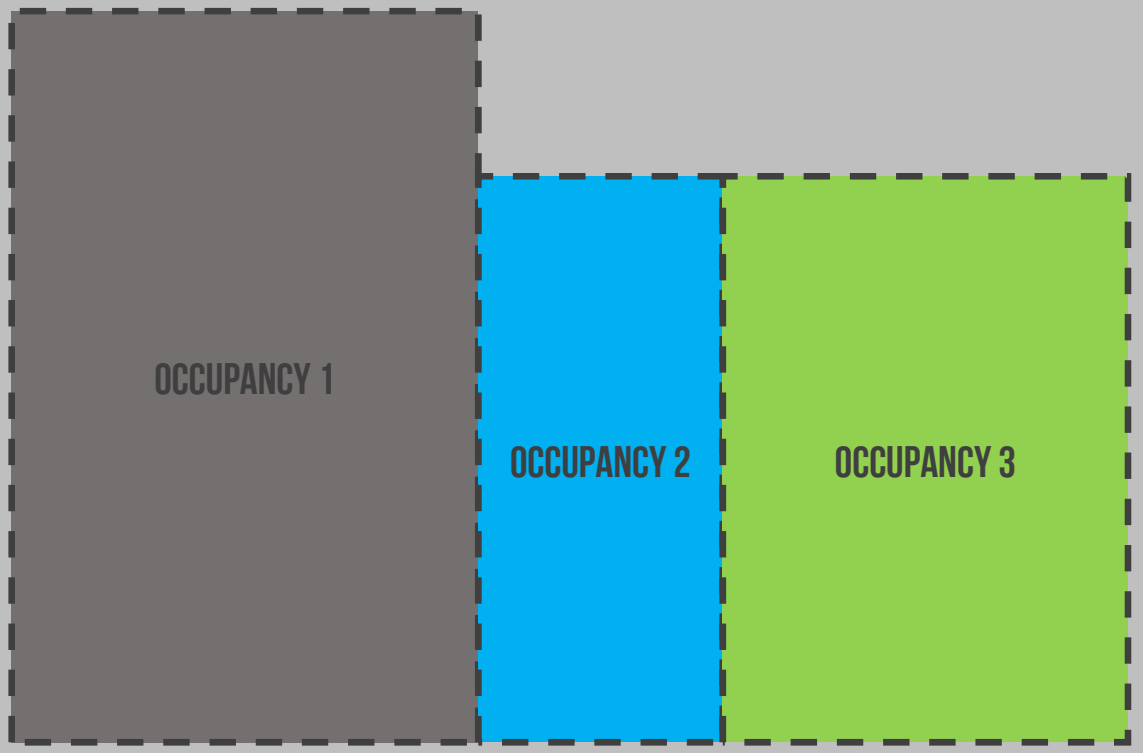
BUILDING CONFIGURATION OPTIONS

START WITH THE LOWEST COMMON DENOMINATOR OPTION & 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 CREDIT: NEO STUDIO

MIXED OCCUPANCY BUILDINGS

IBC 508



MIXED OCCUPANCY BUILDINGS

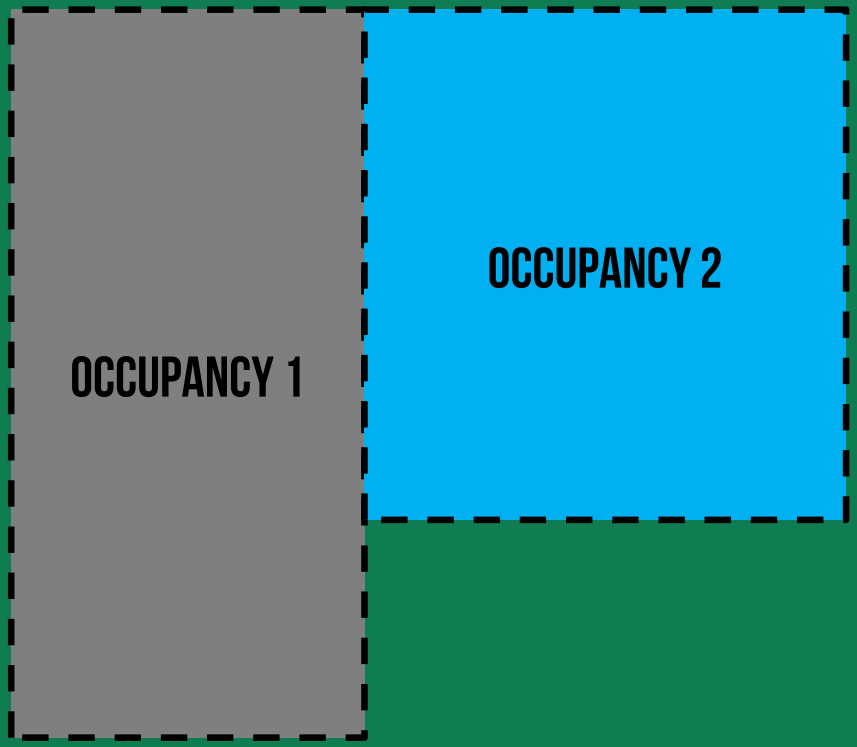
IBC 508

START WITH UNSEPARATED OCCUPANCIES, USING SPECIAL PROVISIONS AND/OR OTHER SPECIAL DESIGN ALLOWANCES AS NEEDED. WORK UP FROM THERE.

ALLOWABLE BUILDING SIZE

IBC 508

NON-SEPARATED OCCUPANCIES



Most restrictive requirements of all occupancies apply for:

- Fire Protection Systems (Chapter 9)
- Allowable Height and Area

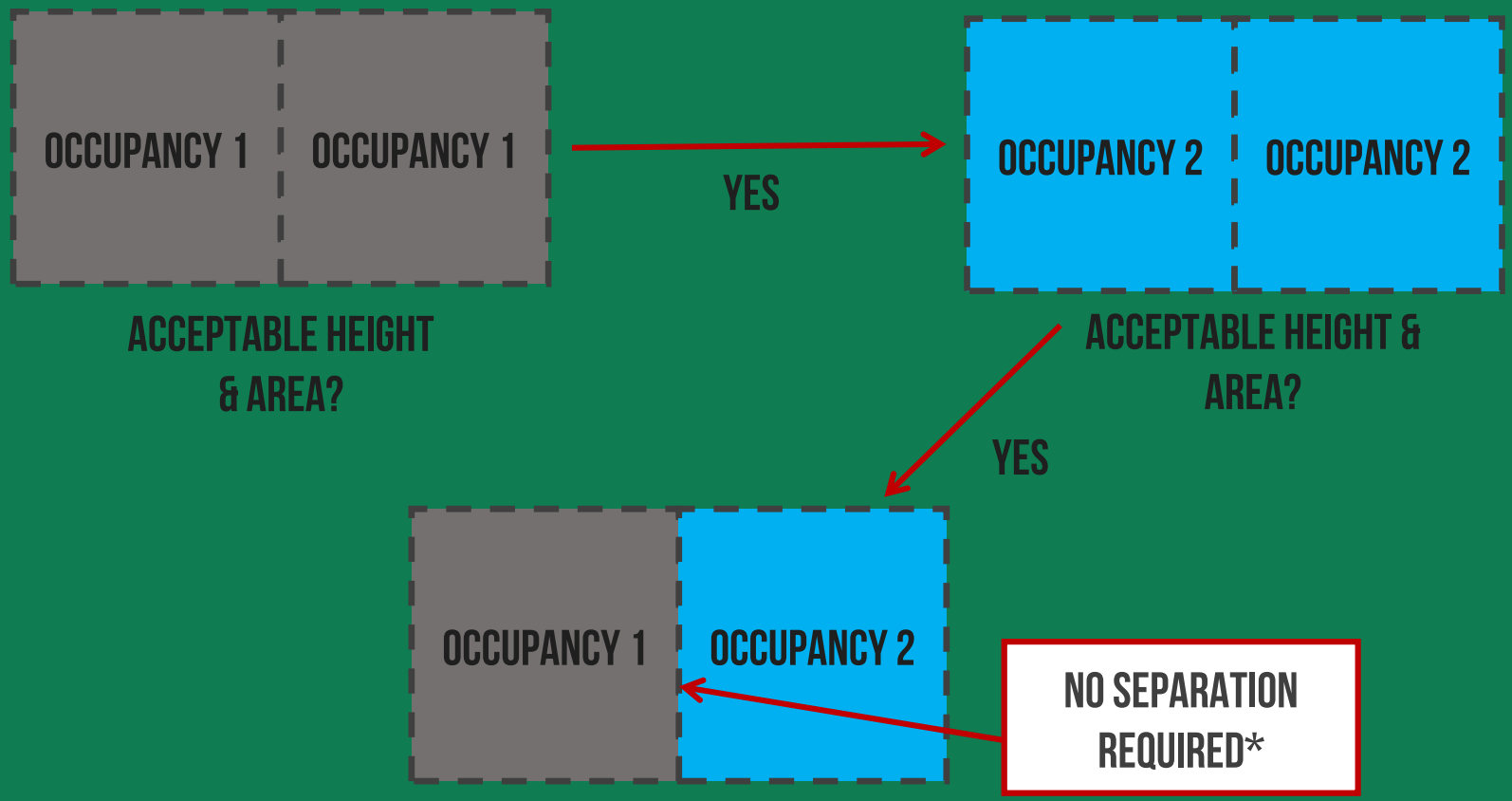
Other requirements for each portion based upon occupancy of that portion (i.e. egress, others)

No fire separation between occupancies required*

*Hazardous occupancies require separation.

NON-SEPARATED OCCUPANCIES

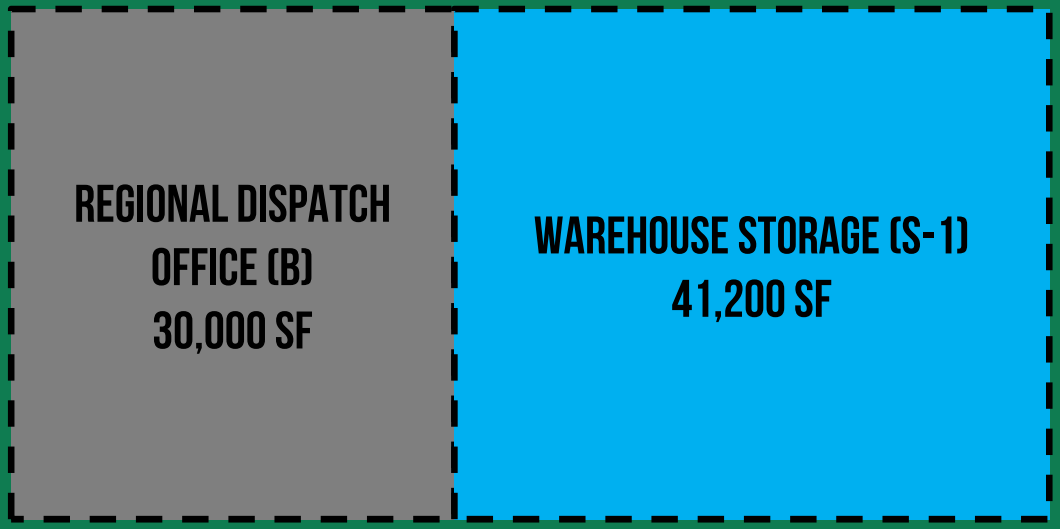
IBC 508.3



ALLOWABLE BUILDING SIZE

IBC 508

NON-SEPARATED OCCUPANCIES EXAMPLE

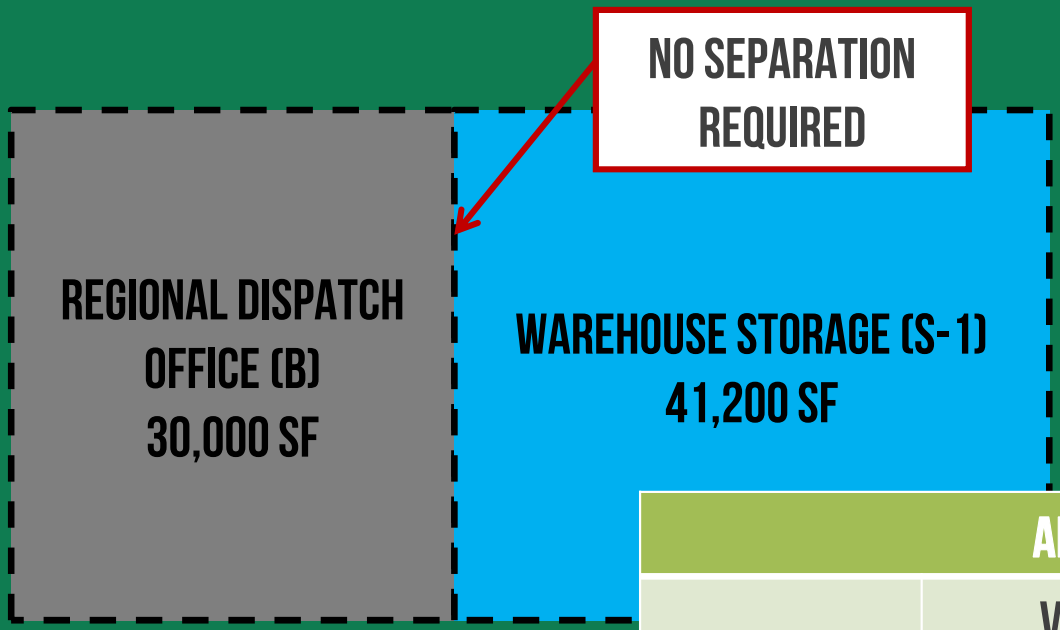


- 1 story building
- Total building area = 71,200 sf
- IBC section 903 does not require an automatic sprinkler in group B buildings but it does for S-1 buildings with fire area > 12,000 sf (903.2.9)
- NFPA 13 sprinkler required throughout building

ALLOWABLE BUILDING SIZE

IBC 508

NON-SEPARATED 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, <u>USE TYPE IIIA</u>

ALLOWABLE 1 STORY BUILDING AREA				
	VB	VA	IIIB	IIIA
GROUP B	36,000 SF	72,000 SF	76,000 SF	114,000 SF
GROUP S-1	36,000 SF	56,000 SF	70,000 SF	104,000 SF

ASSUMPTIONS:
NFPA 13 SPRINKLER THROUGHOUT.
NO FRONTAGE INCREASE.

MIXED OCCUPANCY BUILDINGS

IBC 508

EXAMPLE: URBAN INFILL PROJECT

3 story building
1 story below grade: 12,000 sf parking

1st floor: 9,500 sf parking, 1,200 sf insurance agency, 1,300 sf print shop
2nd floor: 2,400 sf martial arts studio, 9,600 sf apartments
3rd floor: 12,000 sf apartments

NFPA 13 sprinkler system throughout building; enclosed parking garage, grade to mean roof height = 38 ft

MIXED OCCUPANCY BUILDINGS

IBC 508

PER IBC 503 & 506, BASEMENT DOES NOT NEED TO BE INCLUDED IN AREA AND STORY CALCULATIONS

	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	-	-	-	-

MIXED OCCUPANCY BUILDINGS

TRY TYPE VB CONSTRUCTION:

IBC 508

	S-2	B	R-2	ACTUAL BUILDING
ALLOW. # STORIES	3	3	3	3
ALLOW. HEIGHT	60 FT	60 FT	60 FT	38 FT
ALLOW. AREA/FLOOR	40,500 SF	27,000 SF	21,000 SF	12,000 SF
ALLOW. TOTAL AREA	121,500 SF	81,000 SF	63,000 SF	36,000 SF

MOST RESTRICTIVE OCCUPANCY GROUP, R-2 WORKS FOR TOTAL BUILDING.

USE NON-SEPARATED, TYPE VB CONSTRUCTION

MIXED OCCUPANCY BUILDINGS

IBC 508

THIS 3 STORY, TYPE VB MIXED-USE BUILDING CAN BE FULLY FRAMED WITH WOOD AND CAN HAVE NON-SEPARATED OCCUPANCIES

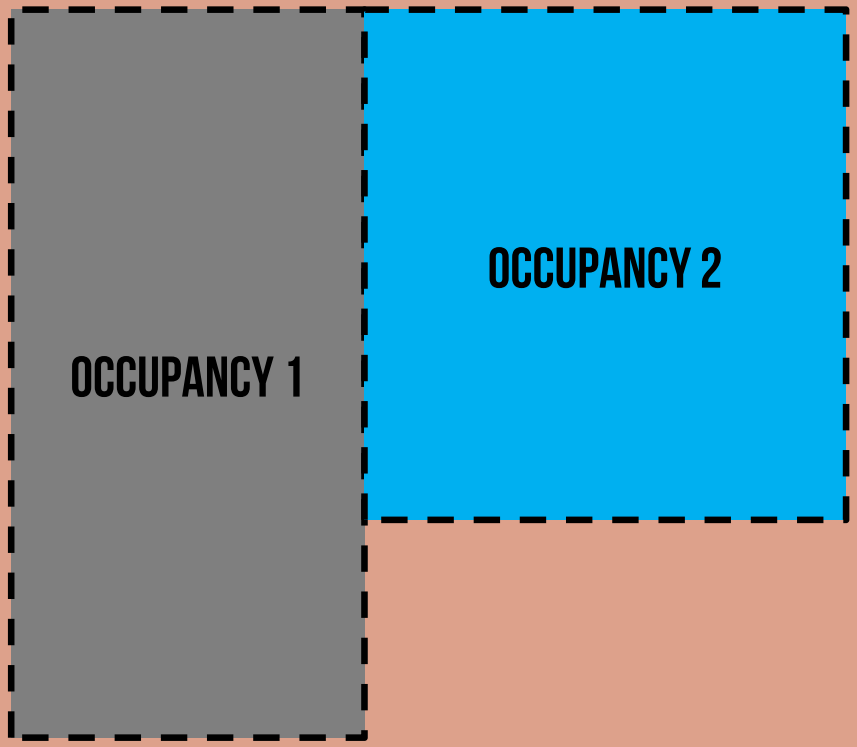
- No podium is necessary
- No fire resistance rated separation between occupancies is necessary (unless required by other code provisions)
- Even if other materials are used in parts of the building, can still be type VB construction

SEPARATED OCCUPANCIES

ALLOWABLE BUILDING SIZE

IBC 508

SEPARATED OCCUPANCIES



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

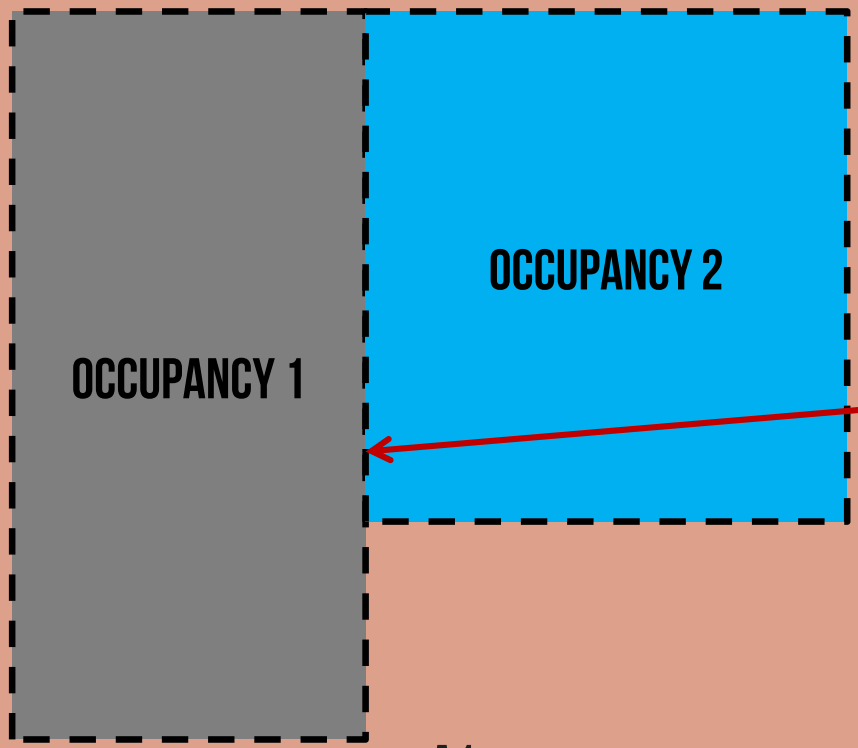
Allowable Height of each occupancy based upon construction type and occupancy

Allowable Area of each story

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

SEPARATED OCCUPANCIES

IBC 508.4



SEPARATION PER TABLE 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[c], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N
H-1	—	—	—	—	—	—	—	—	—	—	—	—
H-2	—	—	—	—	—	—	—	—	—	—	—	—
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—
H-5	—	—	—	—	—	—	—	—	—	—	—	—

NP = NOT PERMITTED

N = NO SEPARATION REQUIRED

SEPARATION ACCOMPLISHED WITH:

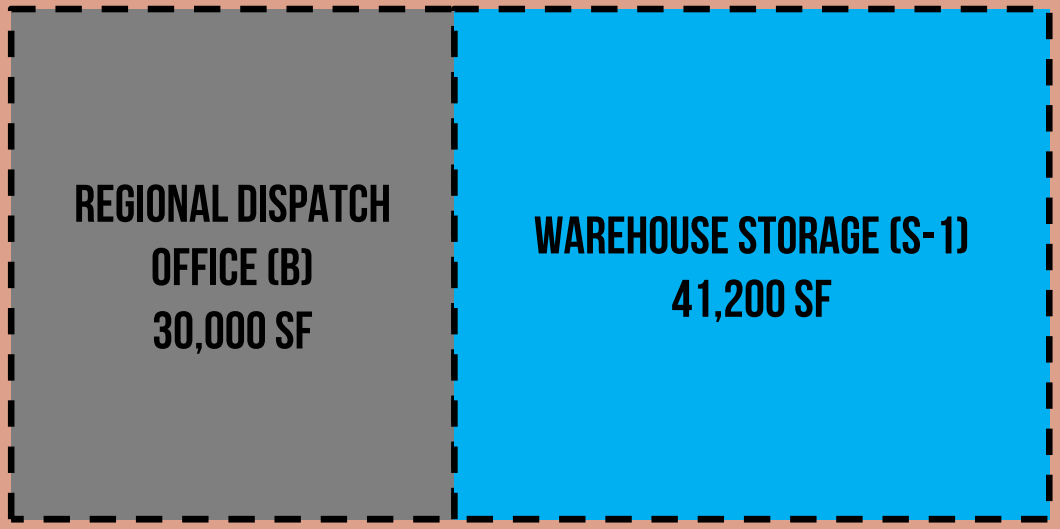
WALLS: FIRE BARRIERS (IBC 707)

FLOORS: HORIZONTAL ASSEMBLIES (IBC 711)

SEPARATED OCCUPANCIES

IBC 508.4

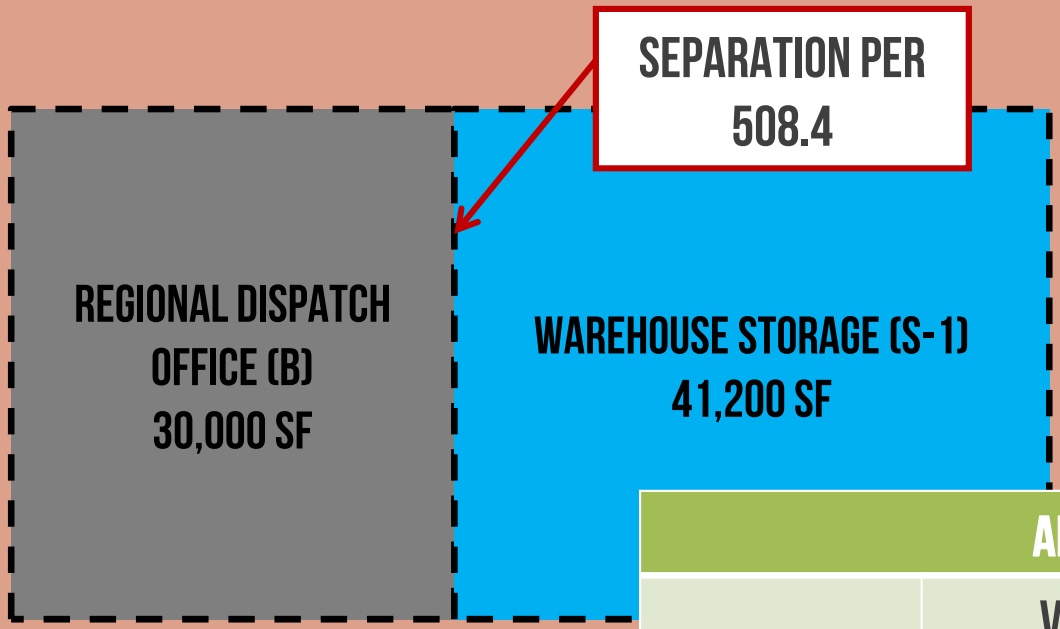
SEPARATED OCCUPANCIES EXAMPLE



- 1 story building
- Total building area = 71,200 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



CONSTRUCTION TYPE OPTIONS

- VB: 30,000/36,000 ± 41,200/36,000 =
  1.98 > 1.0 INADEQUATE
- VA: 30,000/72,000 ± 41,200/56,000 =
  1.15 > 1.0 INADEQUATE
- IIIB: 30,000/76,000 ± 41,200/70,000 =
  0.98 < 1.0 OK. <u>USE TYPE IIIB</u>

ASSUMPTIONS:
NFPA 13 SPRINKLER THROUGHOUT. NO FRONTAGE INCREASE.

ALLOWABLE 1 STORY BUILDING AREA				
	VB	VA	IIIB	IIIA
GROUP B	36,000 SF	72,000 SF	76,000 SF	114,000 SF
GROUP S-1	36,000 SF	56,000 SF	70,000 SF	104,000 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 TABLE 508.4

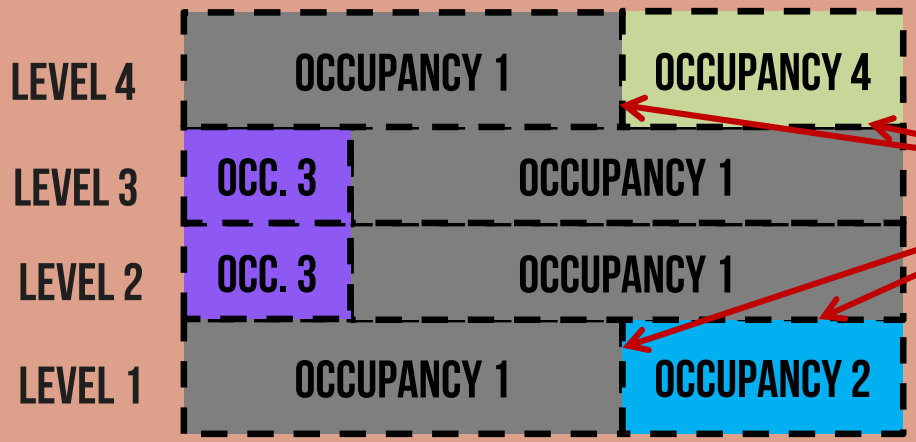
IMAGE CREDIT: CUBE 3 STUDIO LLC & RIXON PHOTOGRAPHY

MULTI-STORY SEPARATED OCCUPANCY BUILDINGS

SEPARATED OCCUPANCIES

IBC 2012 506.5 & 508.4 / IBC 2015 506.2.4 & 508.4

MULTI-STORY SEPARATED OCCUPANCY BUILDINGS



SEPARATION PER TABLE 508.4

ALSO BETWEEN OCC. 1 & OCC. 3

ELEVATION VIEW

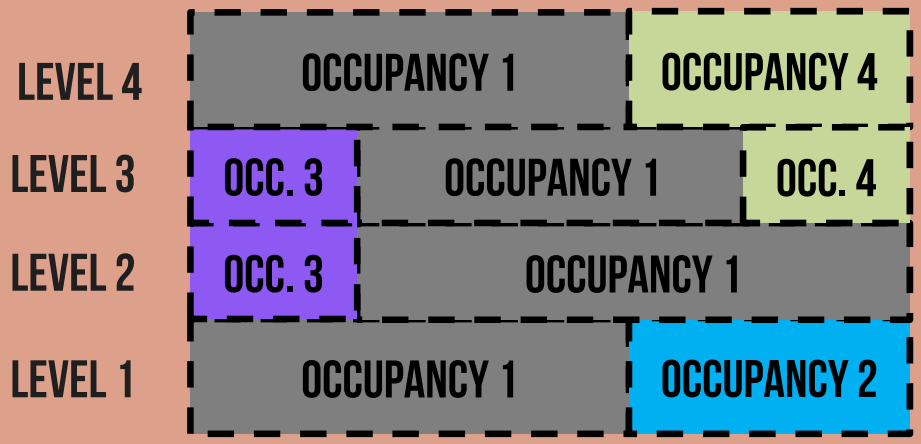
SUM OF RATIOS OF ACTUAL AREA/ALLOWABLE AREA FOR ALL OCCUPANCIES PER FLOOR:

≤ 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

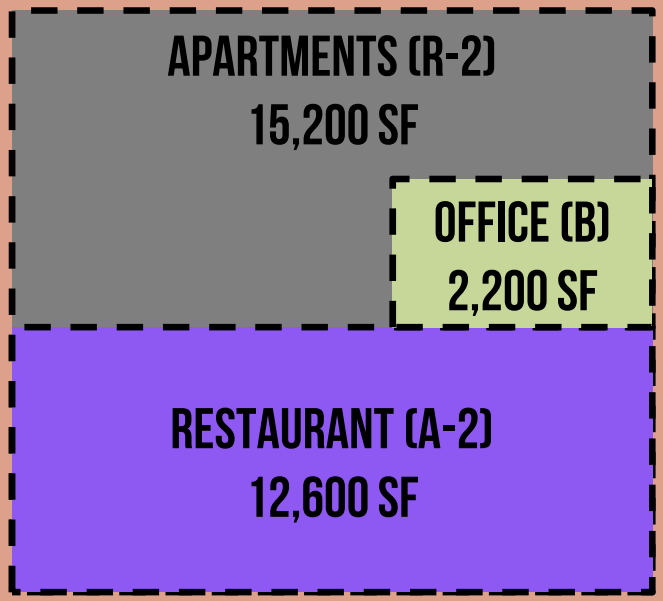
LEVEL 1 FLOOR PLAN

LEVEL 2 FLOOR PLAN

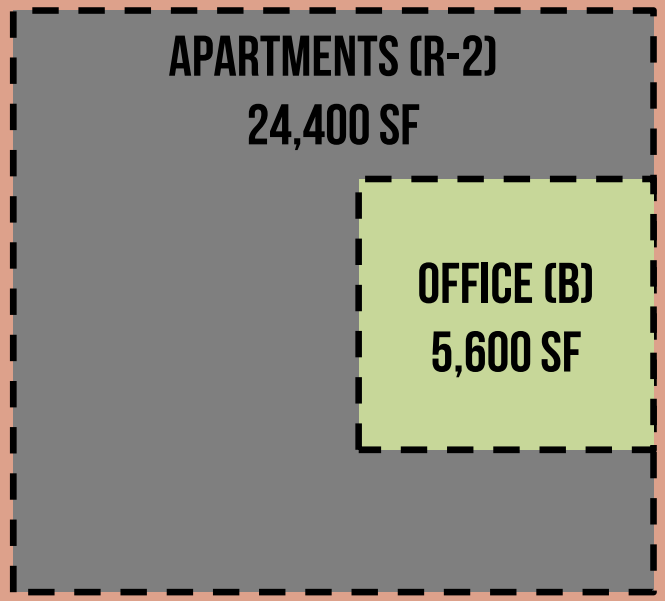
SEPARATED OCCUPANCIES

IBC 508.4

MULTI-STORY SEPARATED OCCUPANCY EXAMPLE



LEVEL 3 FLOOR PLAN



LEVEL 4 FLOOR PLAN

SEPARATED OCCUPANCIES

IBC 503

MULTI-STORY SEPARATED OCCUPANCY EXAMPLE

ALLOWABLE FLOOR AREA / # OF STORIES				
	VB	VA	IIIB	IIIA
GROUP A-2	18,000 SF / 2	34,500 SF / 3	28,500 SF / 3	42,000 SF / 4
GROUP B	27,000 SF / 3	54,000 SF / 4	57,000 SF / 4	85,500 SF / 6
GROUP M	27,000 SF / 2	42,000 SF / 4	37,500 SF / 3	55,500 SF / 5
GROUP R-2	21,000 SF / 3	36,000 SF / 4	48,000 SF / 5	72,000 SF / 5

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

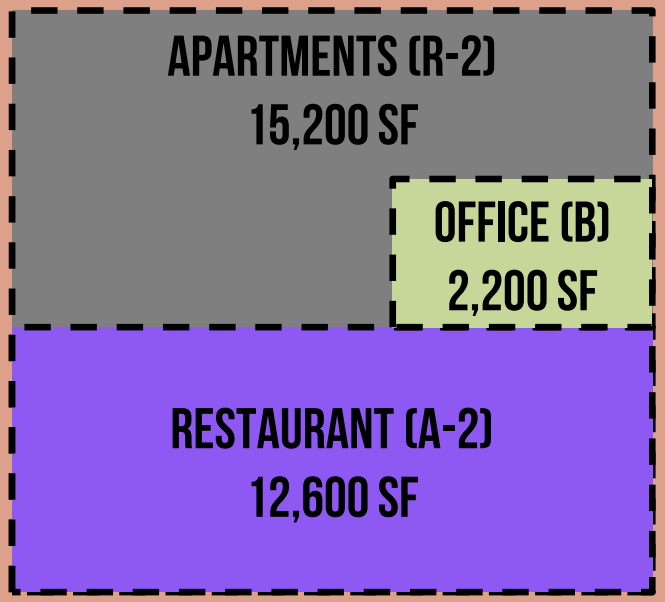
TRY CONSTRUCTION TYPE VA:
VA: 17,400/36,000 ± 12,600/34,500 =
0.85

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

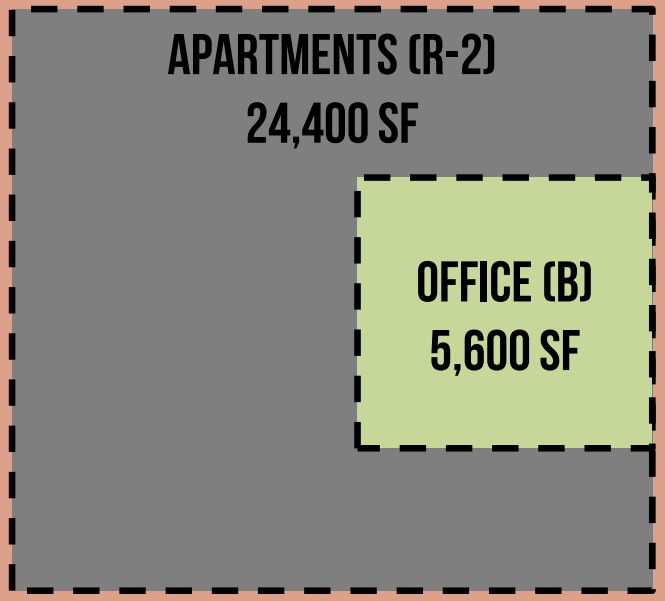
A-2: 70 FT, 3 STORIES - OK

B: 70 FT, 4 STORIES - OK

SEPARATED OCCUPANCIES

IBC 508.4

MULTI-STORY SEPARATED OCCUPANCY EXAMPLE



LEVEL 4 FLOOR PLAN

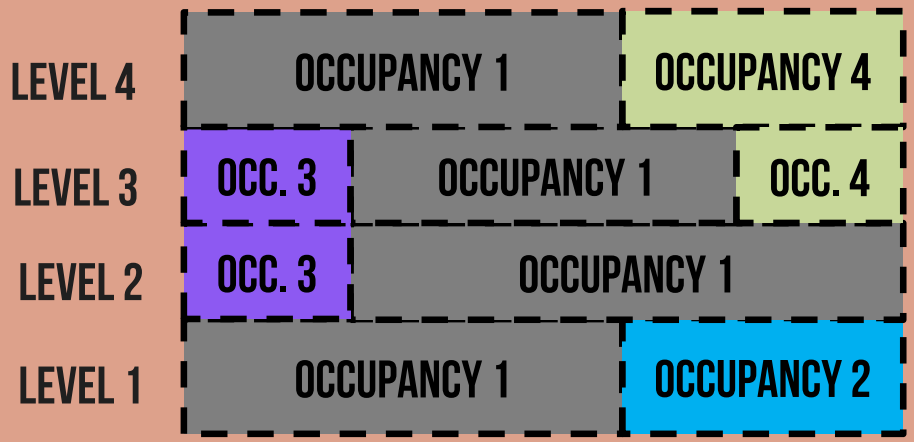
TRY CONSTRUCTION TYPE VA:
VA: 24,400/36,000 ± 5,600/54,000 = 0.78

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[c], 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

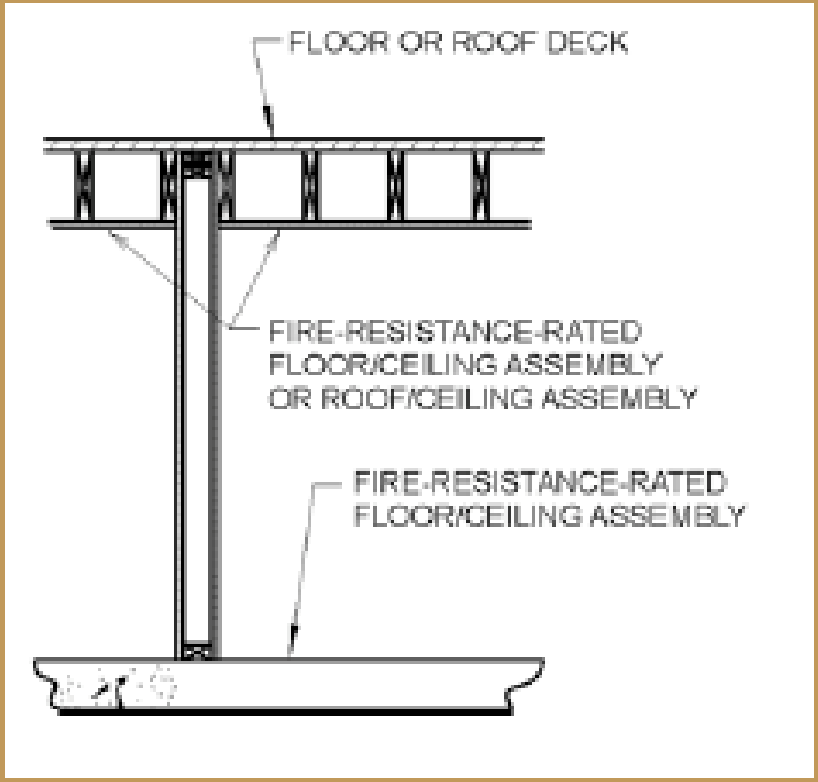
A-2 TO M: 1 HR FLOOR

FIRE BARRIERS

IBC 707

WHAT IS A FIRE BARRIER?

- May be constructed with any materials permitted by the construction type
- Occupancy separation: Fire resistance ratings per IBC Table 508.4
- Required to extend from top of the foundation/floor below to underside of floor/roof sheathing, slab or deck above
- Supporting construction required to have same fire-resistance rating as the fire barrier being supported
- Other requirements for openings, penetrations, joints



2012 IBC CODE & COMMENTARY

FIRE BARRIERS

IBC 707

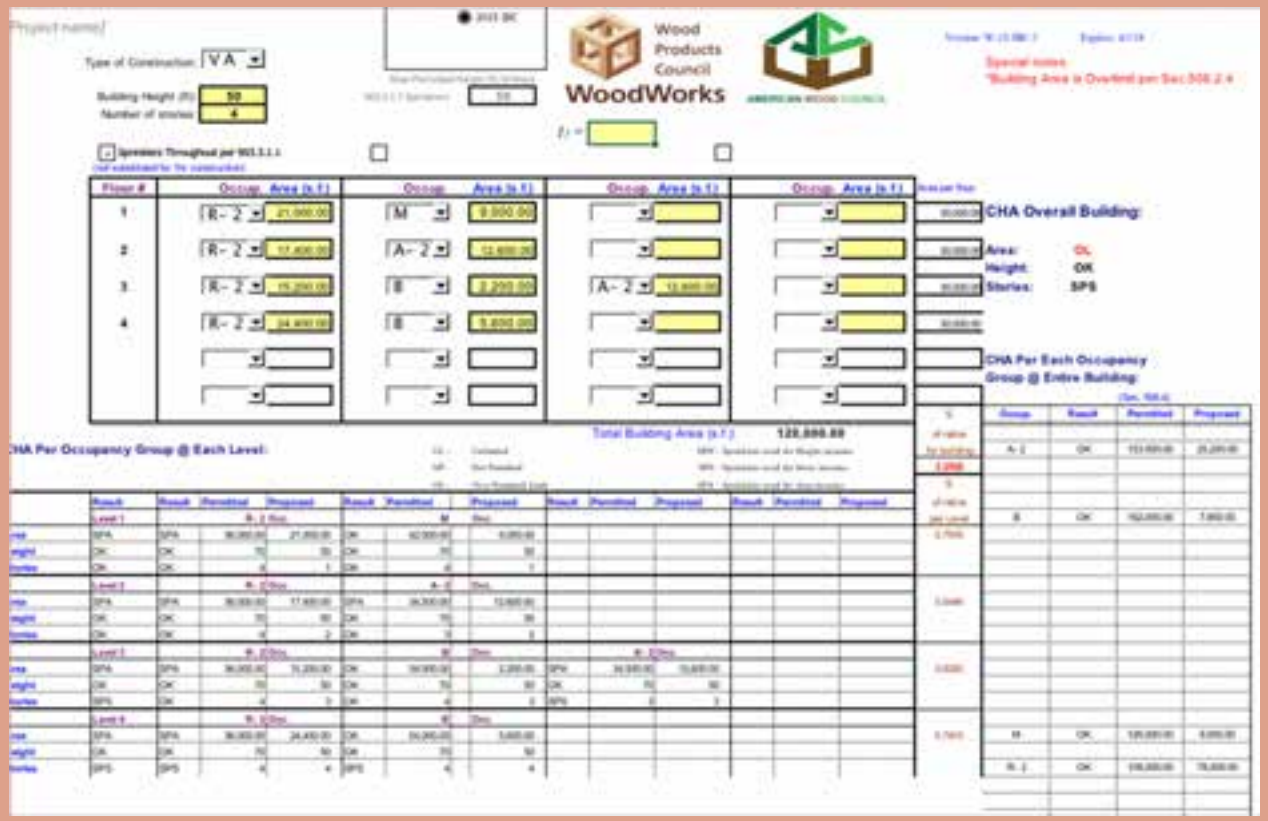
COMMON DETAILING METHOD: FIRE BARRIER & MEMBRANE EXTEND TO UNDERSIDE OF FLOOR DECK ABOVE

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”)



SEPARATE BUILDINGS

SEPARATE BUILDINGS

EXAMPLE:

5 story hotel

1st floor: lobby, restaurant, fitness center, conference rooms, residential

2nd-5th floors residential

5-story, type III (with or without firewalls for area limitations)

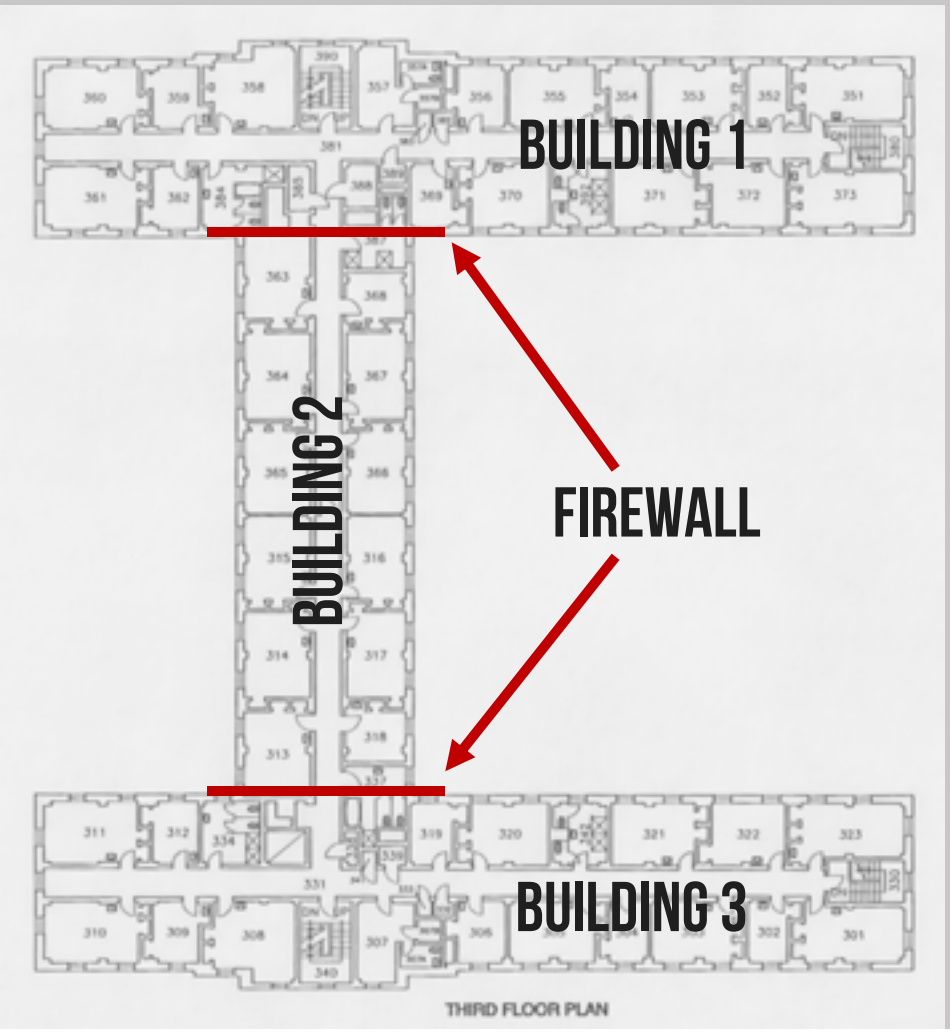
Mixed-use on 1st floor handled with separated/non-separated occupancies considering all floors

SEPARATE BUILDINGS

EXAMPLE:

T- AND L-SHAPED BUILDINGS – COMMON IN HOTELS, OFTEN WITH LARGE FLOOR AREAS

SEPARATE BUILDINGS

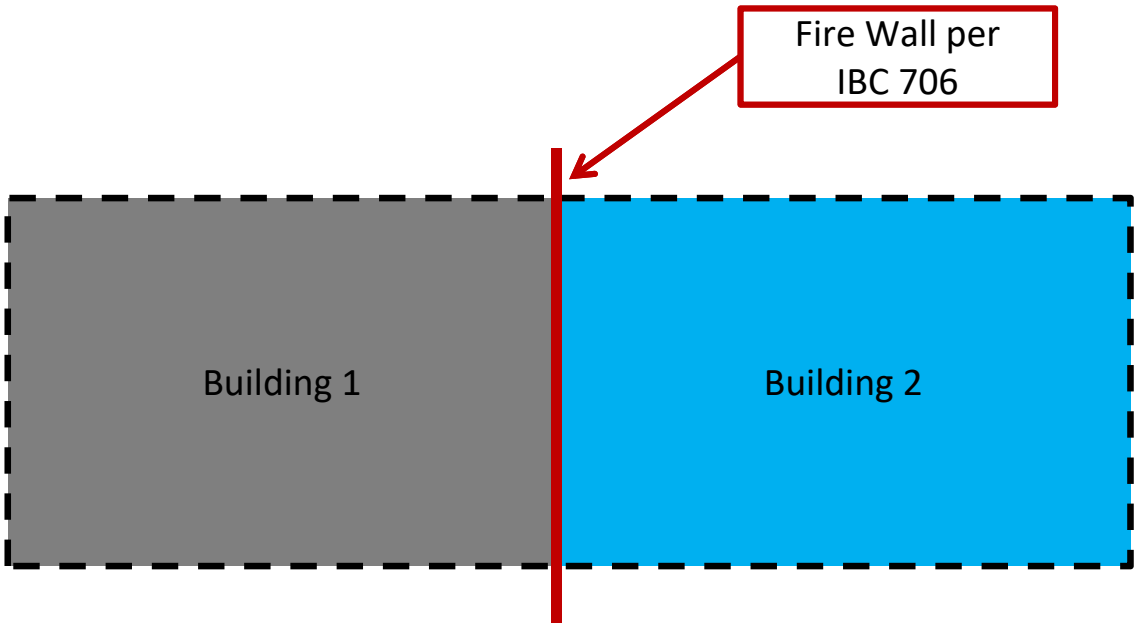


These building configurations may lend themselves well to use of firewalls at building intersections.
Minimize length/impact of firewall while maximizing allowable building area
may allow lower construction type (i.e. type IIIB instead of IIIA)

FIRE WALLS

IBC 706

SEPARATE BUILDINGS – FIRE WALLS



EACH PORTION OF A BUILDING SEPARATED BY ONE OR MORE FIRE WALLS SHALL BE CONSIDERED TO BE A SEPARATE BUILDING

SPECIAL PROVISIONS

IBC 510.5

GROUP R-1 & R-2, TYPE IIIA BUILDINGS

- Height limitation increased to 6 stories & 75 ft
- First floor assembly above the basement has a fire-resistance rating of not less than 3 hours
- Floor area is subdivided by 2-hour fire- resistance-rated fire walls into areas of not more than 3,000 square feet

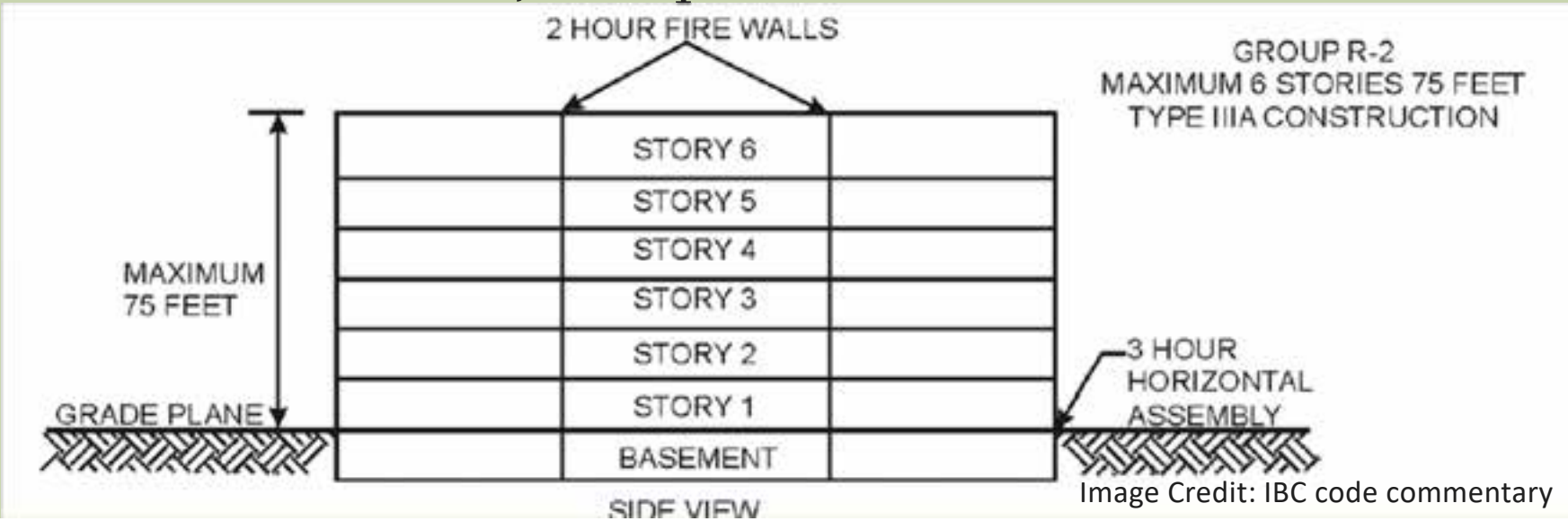


Image Credit: IBC code commentary

SPECIAL PROVISIONS

IBC 510.2

HORIZONTAL BUILDING SEPARATION

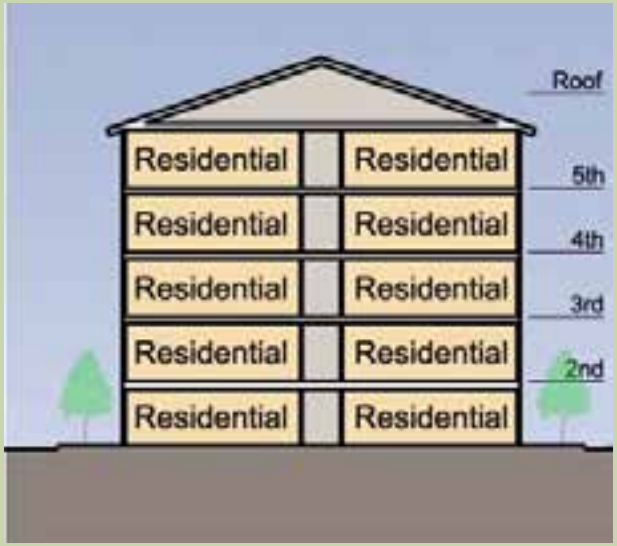
OFTEN CALLED PODIUM PROVISION:

- Considered separate buildings above and below for purposes of area calculations if:
- Overall height in feet is still limited to min of either building
- 3hr rated horizontal assembly
- Building below is Type 1A with sprinklers
- Occupancy restrictions above and below

SPECIAL PROVISIONS

HORIZONTAL BUILDING SEPARATION

IBC 510.2



5 STORY TYPE III BUILDING

3HR

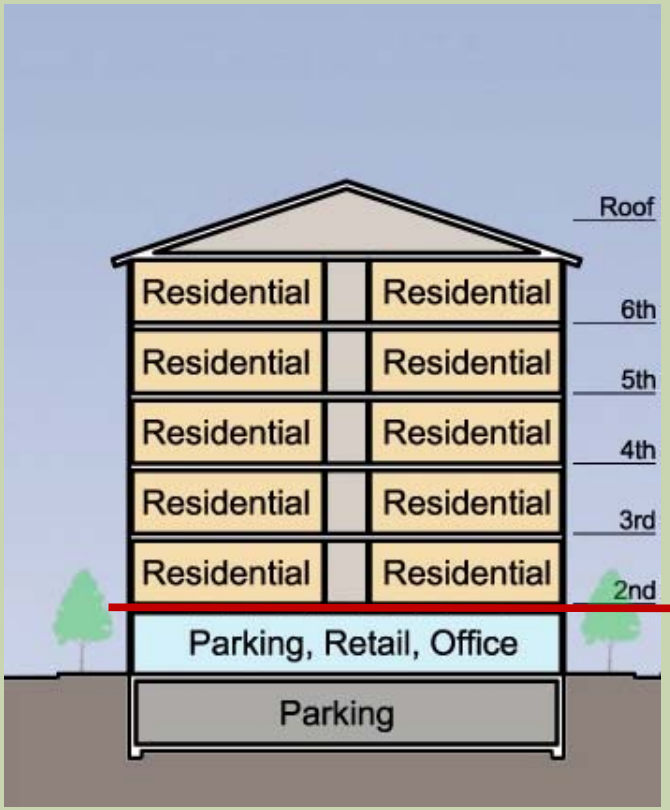
TYPE IA

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
SECTION	509.2	509.2	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

2015 IBC ALLOWS MULTIPLE PODIUM STORIES ABOVE GRADE.

SEPARATE BUILDINGS

EXAMPLE:

5 story hotel

1st floor: lobby, restaurant, fitness center, conference rooms, residential

2nd-5th floors residential

4-story, type VA over 1 story type IA (podium provision – IBC 510.2)

Mixed-use on 1st floor handled with separated/non-separated occupancies considering that floor only

SPECIAL PROVISIONS

IBC 510.2

6 & 7 STORY MIXED-USE POSSIBILITIES

5 STORIES OF TYPE III
OVER 1 STORY PODIUM

5 STORIES OF TYPE III
OVER 2 STORY PODIUM

PHOTO CREDIT: MATT TODD & PB ARCHITECTS

SPECIAL PROVISIONS

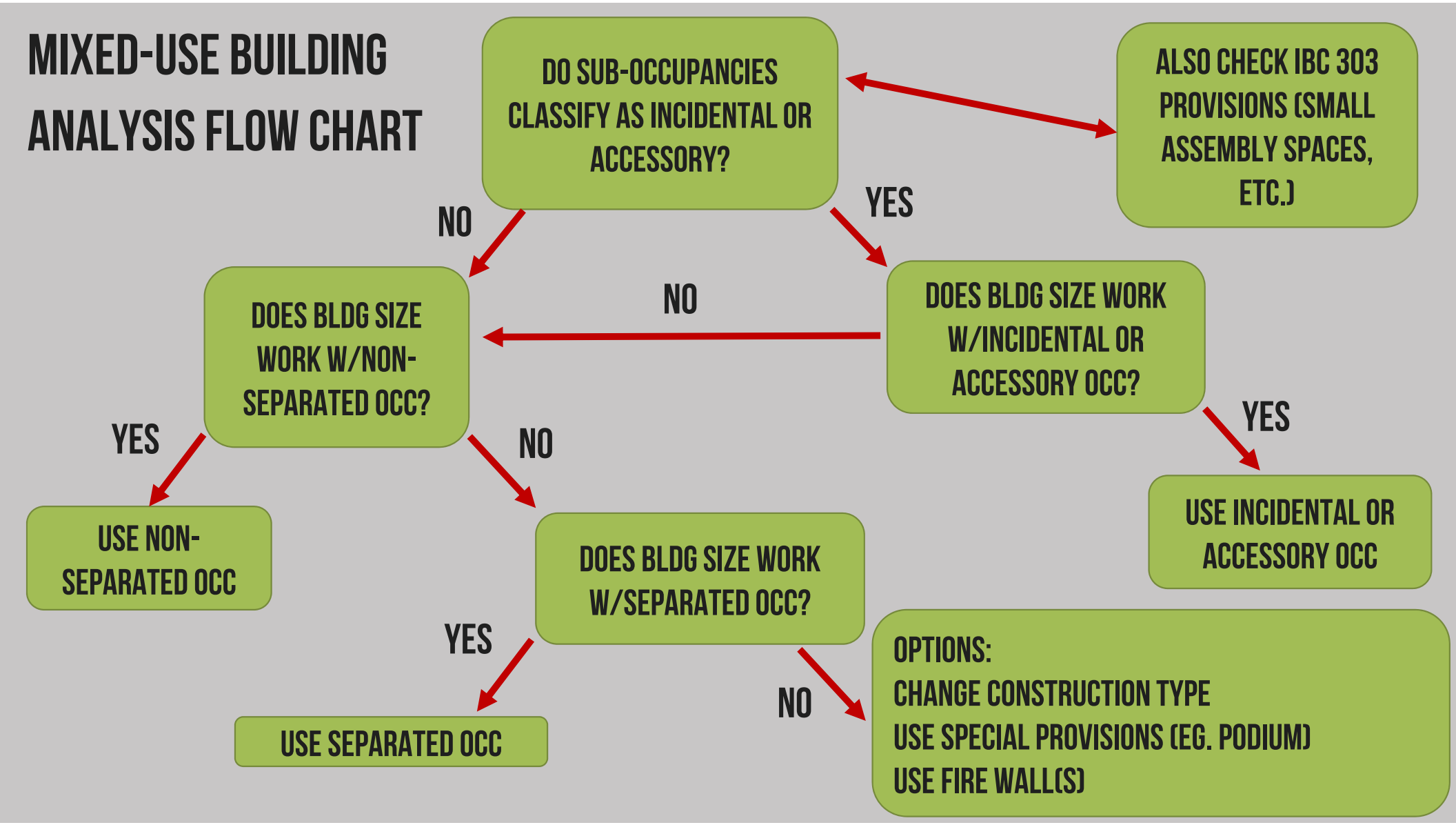
IBC 510.2

7 STORY MIXED-USE POSSIBILITIES

6 STORIES OF TYPE IIIA OR IV
OVER 1 STORY PODIUM

Image Credit: Michael Green Architects/Hines Group

MIXED-USE BUILDING ANALYSIS FLOW CHART



Questions?

This concludes The American Institute of Architects Continuing Education Systems Course

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