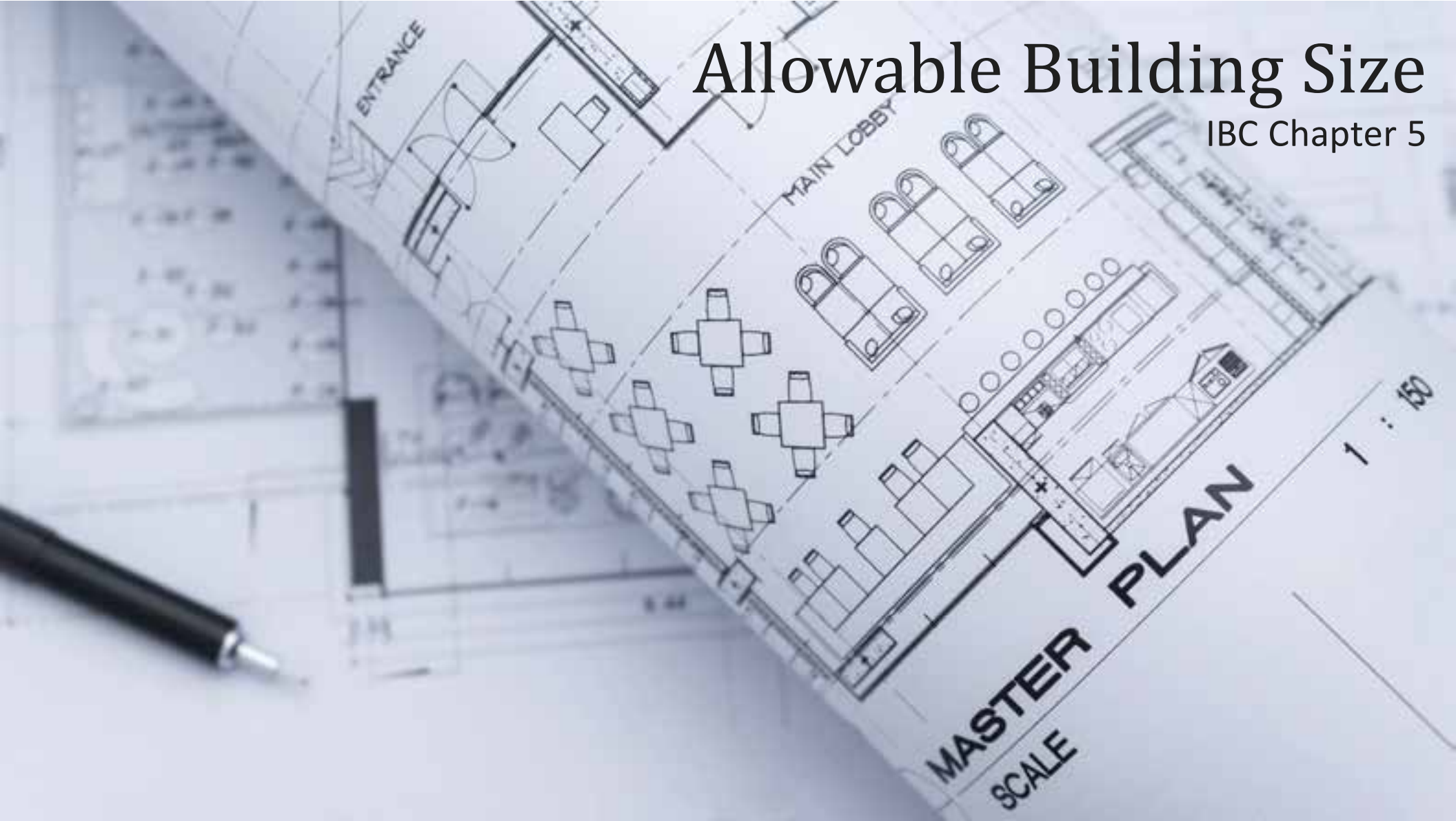


# Allowable Building Size

IBC Chapter 5



# Allowable Building Size

IBC Chapter 5

Allowable building size a function of:

- » Building use (occupancy)
- » Construction type
- » Fire department access
- » Sprinkler protection



# Occupancy Groups

IBC Chapter 3

Mixed-use buildings often have 2, 3 or more different occupancy groups. Common examples include:

**A:** *Assembly*: restaurant, theater, arena, lecture hall

**B:** *Business*: office building, college, bank

**M:** *Mercantile*: retail store, sales room

**R:** *Residential*: apartment, dormitory, hotel

**S:** *Storage*: parking, bulk material storage

# Construction Types

IBC Section 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 into **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<sup>a</sup>**

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 <sup>b</sup>	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<sup>a, b</sup>**

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 ( $A_f$  = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET<sup>a, b</sup>**

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

# Construction Type Differences

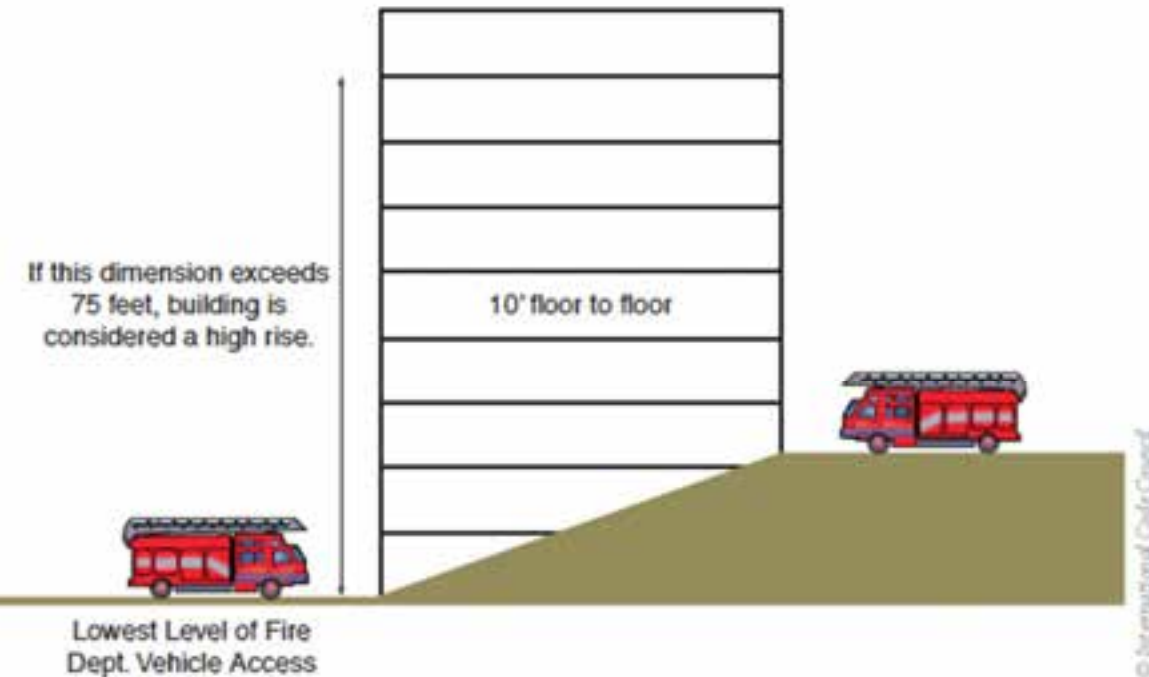
	IIIA	IIIB	IV	VA	VB
Ext Wall Material	FRTW	FRTW	FRTW	Any wood	Any wood
Ext Bearing Wall Rating	2 Hr	2 Hr	2 Hr	1 Hr	0 Hr
Interior Elements	Any wood	Any wood	Heavy Timber	Any wood	Any wood
Fire Wall Materials	Non-combustible	Non-combustible	Non-combustible	Any wood	Any wood
Building Size	Typ 2 <sup>nd</sup> largest; often same # of stories as IV but smaller area	Comparable to VA, larger in some cases, smaller in others	Typ largest; often same # of stories as IIIA but larger area	Comparable to IIIB; often 1-2 stories less than IIIA and IV	Smallest; often 1 story less than VA and 1/2 to 2/3 area of VA



# Fire Department Access

IBC Section 202

## Mid-Rise vs. High-Rise



**FIGURE 6-6** Determination of high-rise building

### High-Rise Building:

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

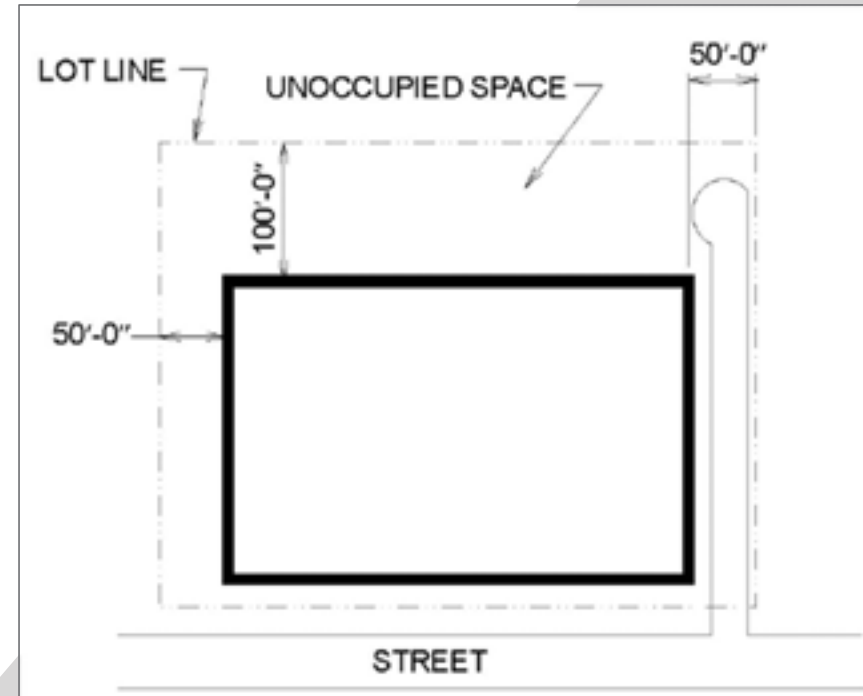


# Fire Department Access

IBC Section 506

## Frontage

Frontage provides access to the structure by fire service personnel, a temporary refuge area for occupants as they leave the building in a fire emergency and a reduced exposure to fire from adjacent structures. Larger building areas are possible with a certain minimum amount of frontage.



# Sprinkler Requirements

IBC Section 903.2



- » NFPA 13 or 13R sprinkler system required in all new group R fire areas
- » NFPA 13 sprinkler system required in most commercial facilities of any size regardless of construction type or materials used
- » Example: Occupancy Group A-2 (restaurant, casino, banquet hall):
  - » If Fire Area Exceeds 5,000 sf, or
  - » If occupant load is 100 or more

# Commercial Sprinkler Systems

IBC Section 903.3.1

» **NFPA 13**

Standard for Commercial Construction 903.3.1.1

» **NFPA 13R**

Residential Occupancies (One- and Two-Family or Low-Rise Multi-Family and Commercial) 903.3.1.2

» **NFPA 13D**

Standard for One- and Two-Family Residences (allowed in a few Commercial Occupancies) 903.3.1.3



# Sprinkler Differences



## NFPA 13

Goal: Provide life safety and property protection

Fully sprinklered system throughout entire building even in unoccupied spaces (closets, attics)

Can cost more

Permitted for many occupancies, buildings of many sizes, allows greater building size increases

## NFPA 13R

Goal: Provide life safety only

Partially sprinklered system; unoccupied spaces often don't require sprinklers

Lower levels of water discharge, shorter water supply time can result in smaller pipe sizes, reduce need for storage & pumps

Limited applications, mainly for multi-family up to 4 stories, 60 feet

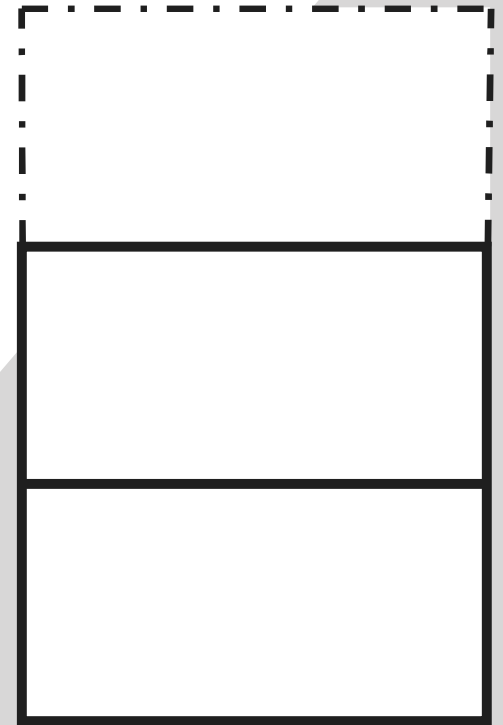
# Allowable Building Height

IBC Tables 504.3 & 504.4

## Building Height Increase for Sprinklers

Buildings equipped throughout with an NFPA 13 or 13R\* sprinkler system are generally allowed an additional **1 story and 20 ft** over (non-sprinklered) base heights

\*NFPA 13R limited to 60 ft & 4 stories



# Allowable Building Height

IBC Table 504.3

Provides (non-sprinklered) base heights & increased heights

**TABLE 504.3\***  
**ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE**

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 <sup>b</sup>	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
R	NS <sup>d, b</sup>	UL	160	65	55	65	55	65	50	40
	S13R	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	85	70	60

**NS** = Buildings not equipped throughout with an automatic sprinkler system

**S** = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 (NFPA 13)

**S13R** = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2 (NFPA 13R)

**S13D** (not shown) = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3 (NFPA 13D)

# Allowable Number of Stories

Provides (non-sprinklered) base no. of stories & increased no. of stories IBC Table 504.4

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	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-3	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	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
R-1	NS <sup>d, h</sup>	UL	11	4	4	4	4	4	3	2
	S13R	4	4						4	3
	S	UL	12	5	5	5	5	5	4	3
R-2	NS <sup>d, h</sup>	UL	11	4	4	4	4	4	3	2
	S13R	4	4	4					4	3
	S	UL	12	5	5	5	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	3	1
	S	UL	12	5	3	4	3	5	4	2

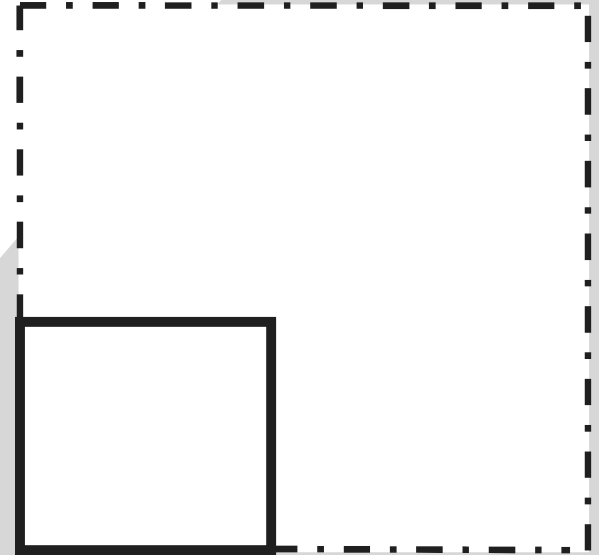


# Allowable Story Area

IBC Table 506.2

## Area Factor Increase for Sprinklers

Buildings equipped throughout with an NFPA 13 sprinkler system can have (non-sprinklered) base area factors increased **300% for single story buildings** or **200% for multi-story buildings**

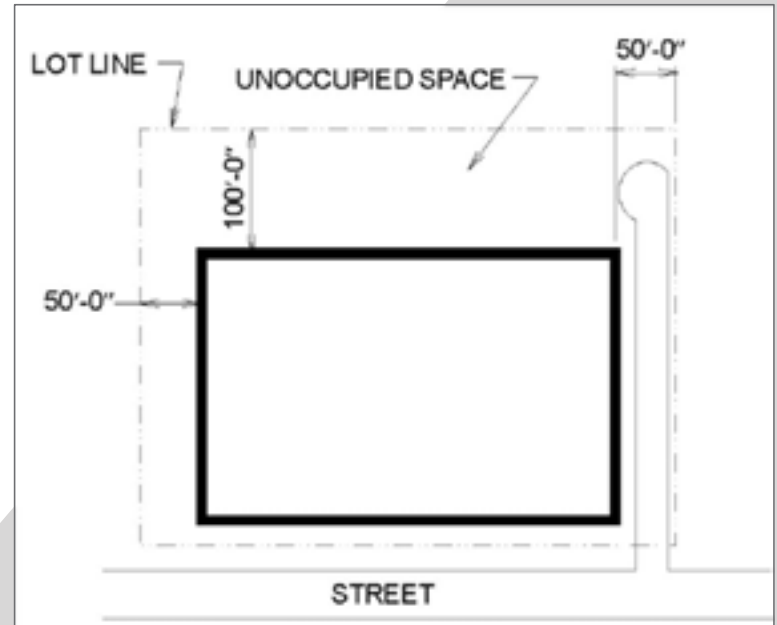


# Allowable Story Area

IBC Section 506.3

## Area Factor Increase for Frontage

Buildings with minimum levels of open frontage can have (non-sprinklered) base area factors increased **up to 75%** for use in calculating allowable story area



# Allowable Area Factors (per story)

Provides (non-sprinklered) base area factors & increased area factors

IBC Table 506.2

**TABLE 506.2<sup>a, b</sup>**  
**ALLOWABLE AREA FACTOR ( $A_f$  = 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
R-1	NS <sup>d, h</sup>	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
	S13R									
	S1	UL	UL	96,000	64,000	96,000	64,000	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	61,500	36,000	21,000

\*\*Can still increase these areas by the Frontage Factor of Section 506.3

**NS** = Buildings not equipped throughout with an automatic sprinkler system

**S1** = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 (NFPA 13)

**SM** = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 (NFPA 13)

**S13R** = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2 (NFPA 13R)

# Allowable Building Size

IBC Section 506.2.3

## Total Building Area (Single-Occupancy)

Total allowable building area =  
allowable area per story times:  
2 for 2-story buildings,  
3 for 3 or more-story buildings



# Building Size Limits (Sprinklers & Frontage)

IBC Chapter 5

Residential (R-1, R-2 & R-4) Occupancies: **Type IIIA Construction**

Allowable Limit	NS	NFPA 13R	NFPA 13	Frontage Increase**
Stories	4	4	5	5
Building Height (ft)	65	60	85	85
Story Area (ft <sup>2</sup> )	24k	24k	72k	90k
Total Building Area* (ft <sup>2</sup> )	72k	72k	216k	270k

\* Assuming max stories built  
\*\* Maximum allowable frontage increase

# Building Size Limits (Construction Type)

IBC Chapter 5

Residential (R-1, R-2 & R-4) Occupancies: NFPA 13 Sprinkler System

Allowable Limit	IIIA	IIIB	IV (HT)	VA	VB
Stories	5	5	5	4	3
Building Height (ft)	85	75	85	70	60
Story Area* (ft <sup>2</sup> )	90k	60k	76.9k	45k	26.3k
2 story: Total Bldg Area (ft <sup>2</sup> )	180k	120k	153.8k	90k	52.5k
3+ story: Total Bldg Area (ft <sup>2</sup> )	270k	180k	230.6k	135k	78.8k

\*Assumes full frontage increase

# Building Configuration Options

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





# Building Configuration Options

In low- to mid-rise building types, many designers accustomed to designing with steel and concrete default to type II construction

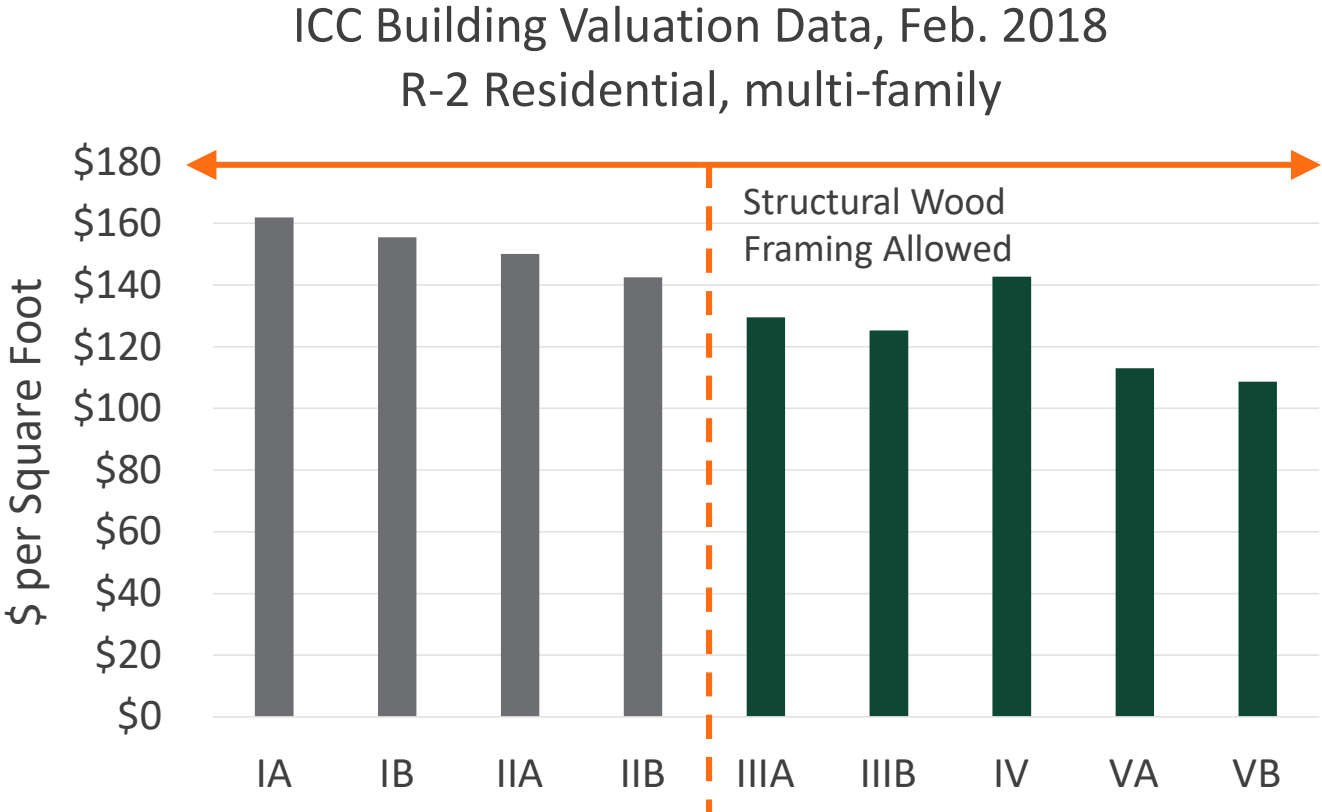
However, nearly identical building sizes can be achieved with wood framing in type IIIA or IIIB

Additionally, market data analysis has shown that majority of commercial & multi-family buildings can be type V construction

**Why is the construction type selection so important?**



# ICC Building Valuation Data



# Special Provisions

IBC Sections 510 & 602.1

## Construction Types

IBC Section 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 multiple construction types in the same building or multiple “buildings” stacked on top of each other.



Photo: Arden Photography

# Special Provisions

IBC Section 510.2

## Horizontal Building Separation

Often called the “*podium*” provisions:

Considered separate buildings above and below for purposes of area calculations if:

- » Overall height in feet is still limited to min of either building
- » Separation provided by 3-hr rated horizontal assembly
- » Building below is Type 1A with sprinklers

Occupancy restrictions above and below



# Special Provisions

IBC Section 510.2

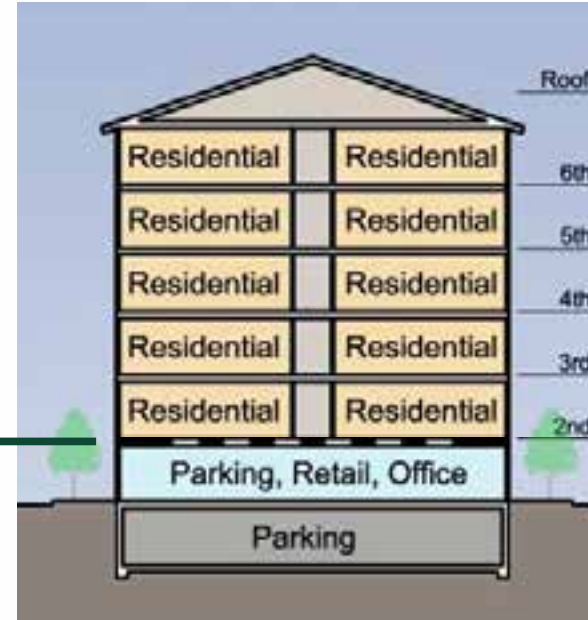
## Horizontal Building Separation



5-story Type III Building

$3H_r$

Type IA



5-story Type III Building  
on top of a Type IA "podium"

*Increases allowable stories... not allowable building height*



# Allowable Building Size

Heights and areas calculator – free tool

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

Handles Separated & Nonseparated Occupancies (Check “both”)

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**HEIGHTS AND AREAS CALCULATOR**

**Frontage Summary:**

Wall 1:	Clearance:	Length:
	0 ft	250 ft
Wall 2:	Clearance:	Length:
	60 ft	100 ft
Wall 3:	Clearance:	Length:
	40 ft	250 ft
Wall 4:	Clearance:	Length:
	0 ft	100 ft
<b>Frontage Increase Coefficient:</b>		
Frontage Increase Coef., I:	Perimeter, P:	
0.2500	700 ft	

**Viable Construction Types:**

VB Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
3	60 ft	38,250 ft <sup>2</sup>
VA Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
4	70 ft	76,500 ft <sup>2</sup>
IVHT Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:

Done

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**HEIGHTS AND AREAS CALCULATOR**

**Viable Construction Types:**

VB Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
3	60 ft	38,250 ft <sup>2</sup>
VA Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
4	70 ft	76,500 ft <sup>2</sup>
IVHT Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
6	85 ft	153,000 ft <sup>2</sup>
IIIB Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
4	75 ft	80,750 ft <sup>2</sup>
IIIA Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
6	85 ft	121,120 ft <sup>2</sup>
IIB Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
4	75 ft	97,750 ft <sup>2</sup>
IIA Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
6	85 ft	159,370 ft <sup>2</sup>
IB Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit:
12	180 ft	UNLIMITED
IA Construction Type:		
Floors Limit:	Height Limit:	Area/Floor Limit: