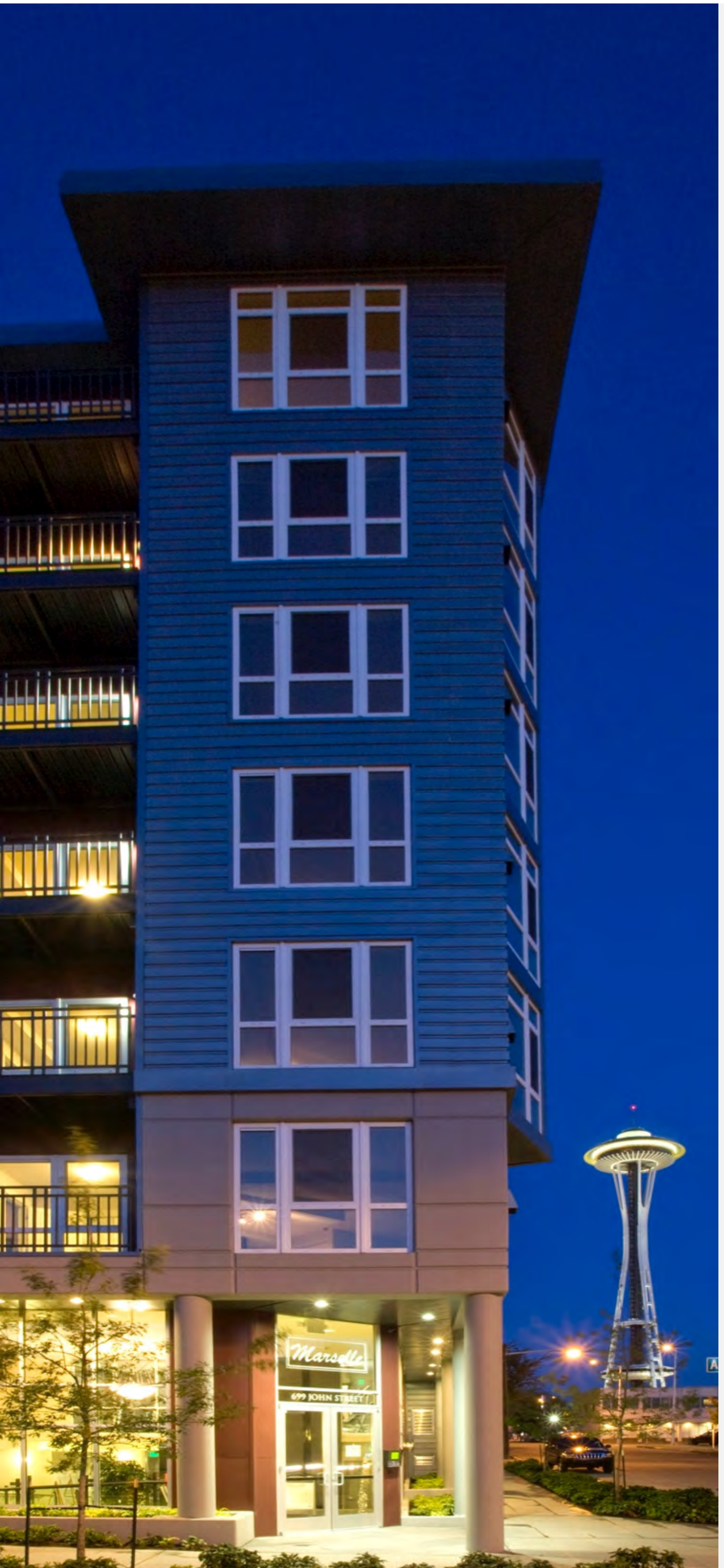


Mid-Rise and Multi-Family Design

Optimizing Size, Maximizing Value

INTRODUCTION TO HEIGHTS AND AREAS
FOR MID-RISE WOOD FRAME BUILDINGS

Jason Bahr, PE
Regional Director – KS, MO, OK and AR
Jason.bahr@woodworks.org
913-732-0075

"The Wood Products Council" is a Registered Provider with The American Institute of Architects Continuing Education Systems (AIA/CES), Provider #G516.

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

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

Course Description

As cities seek increased density to address urban population growth, many building designers and developers are looking to mid-rise wood construction as a cost-effective, code-compliant and sustainable solution. This presentation will cover some of the design considerations associated with mid-rise wood-frame buildings, including how to maximize height and area through the use of sprinklers, open frontage, sloping sites, podiums and mezzanines. Construction types will be reviewed, with an emphasis on opportunities for wood use in types III and V.

Learning Objectives

1. In the context of a shift toward increased urban density, learn how mid-rise, wood-frame construction meets housing needs while contributing to vibrant and sustainable communities.

2. Discuss allowable construction types, occupancies, and building heights and areas for wood-frame mid-rise construction per the 2018 International Building Code.

3. Identify potential modifications to the IBC's base tabular heights and areas based on code provisions for building frontage, sprinklers, sloping sites, podiums and mezzanines.

4. Highlight constructed buildings that were designed using these code provisions to maximize density.

Outline

- Context for Mid-Rise Construction
- Mid-rise Building Types/Configurations
- Maximizing Height & Area

Landing Apartments, Russell Scott Steedle & Capione Architects, photo Gregory Folkins

Outline

- Context for Mid-Rise Construction
- » Mid-rise Building Types/Configurations
- » Maximizing Height & Area

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

Global Population Boom

Global Population

7.3 billion now

9.7 billion by 2050

33% increase

Urban Population

6.4 billion by 2050

62% increase

Source: United Nations Department of Economic and Social Affairs

Sustainable Multi-Family & Mixed-Use Structures

Economically Meet Urban Housing Needs

Increase Environmental Responsibility

These 2 items don't need to be in opposition—
—Wood-framing helps them work together!

Sustainable Multi-Family & Mixed-Use Structures

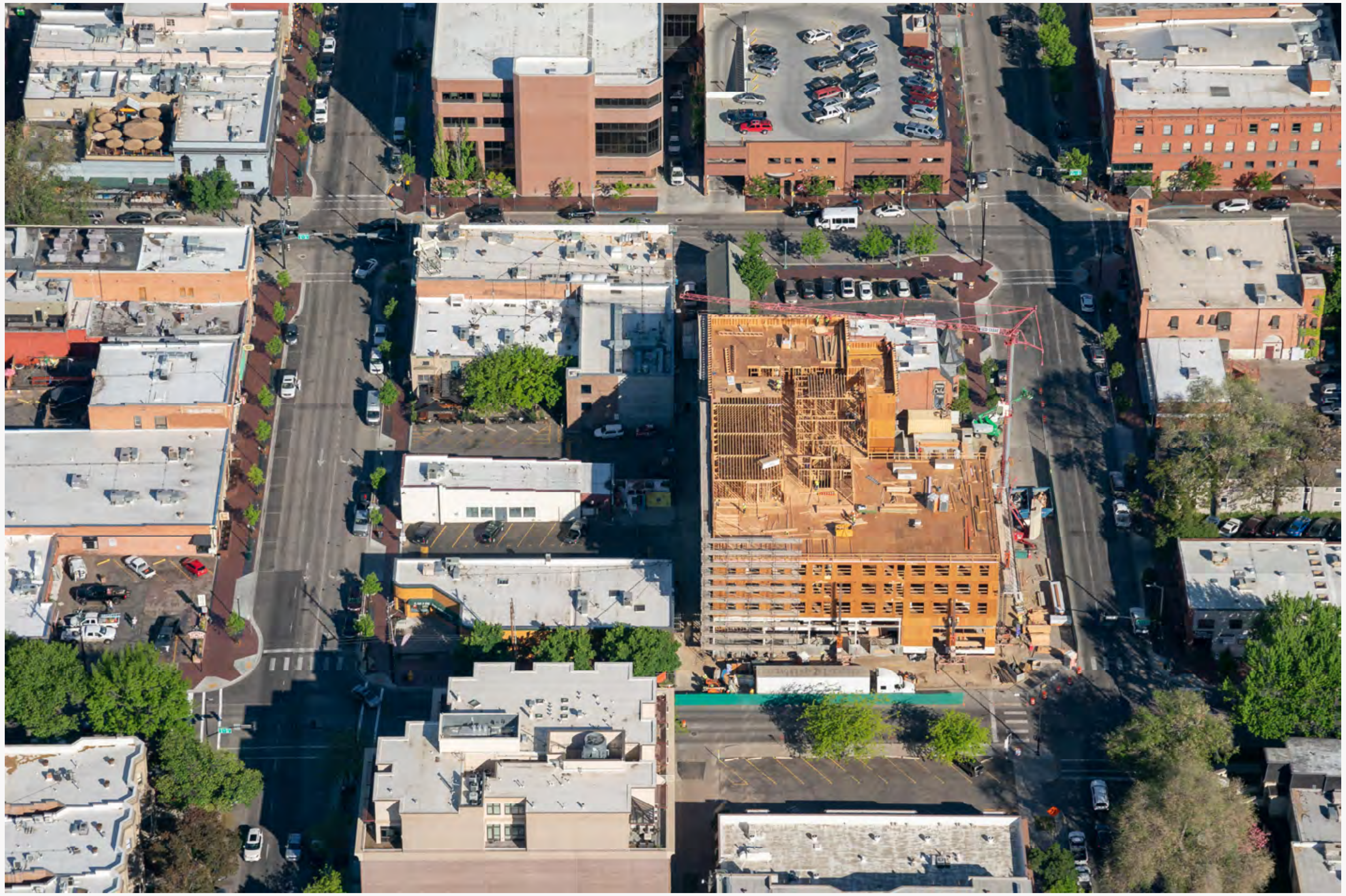
Mid-rise wood-frame construction provides a common ground for both

How?

Mid-Rise Construction

Where **wood** is a viable option,
it's likely the most appropriate choice.

- Senior Living
- Apartments/Condos
- Mixed Use
- Student Housing
- Affordable Housing
- Hotels



The Gibson, Hummel Architects, KPFF Consulting Engineers, photo Leo A. Geis

Why Wood?

Using wood helps reduce environmental impact
Wood products play significant role in modern economy

- Wood Costs Less
- Wood is Versatile
- Wood Meets Code
- Wood is Durable
- Wood is Renewable

Photo courtesy OFRI

The Gibson, Hummel Architects, KPFF Consulting Engineers, photo Leo A. Geis

Urban Infill Development

Case Study | Wood Buildings Aim High

Architect: Withee Malcolm Architects

Engineer: VanDorpe Chou Associates

Developer/Contractor: AvalonBay Communities

Photo credit: Arden Photography

AvalonBay Stadium

Location: Anaheim, CA

251 Apts., 13K sf retail/restaurant

Type III modified

50% of their projects are podium

Semi-balloon framed with 16" Open web trusses at exterior walls

Carbon Case Study | High Density

AvalonBay Stadium- Anaheim, CA

Climate Change Advantage

Volume of wood used:
5,200 cubic meters / 183,600 cubic feet of lumber and sheathing

U.S. and Canadian forests grow this much wood in:
15 minutes

Carbon stored in the wood:
3,970 metric tons of CO_2

Avoided greenhouse gas emissions:
8,440 metric tons of CO_2

TOTAL POTENTIAL CARBON BENEFIT:
12,410 metric tons of CO_2

EQUIVALENT TO:

2,370 cars off the road for a year

Energy to operate a home for 1,050 years

Source: US EPA

For information on the calculations in this chart, visit woodworks.org
Note: CO_2 on this chart refers to CO_2 equivalent.

Outline

- » Context for Mid-Rise Construction
- Mid-rise Building Types/Configurations
- » Maximizing Height & Area

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


Seattle, WA
Photo: Matt Todd/PB Architects


College Park , MD
CAMDEN
Photo: Matt Church


Normal, IL
Image: OKW Architects


Los Angeles, CA
STELLA
3488
Photo: Lawrence Anderson/Esto


Atlanta, GA
Image: Lord Aeck Sargent

Wood Mid-Rise Construction

How many stories can be wood framed in the IBC?

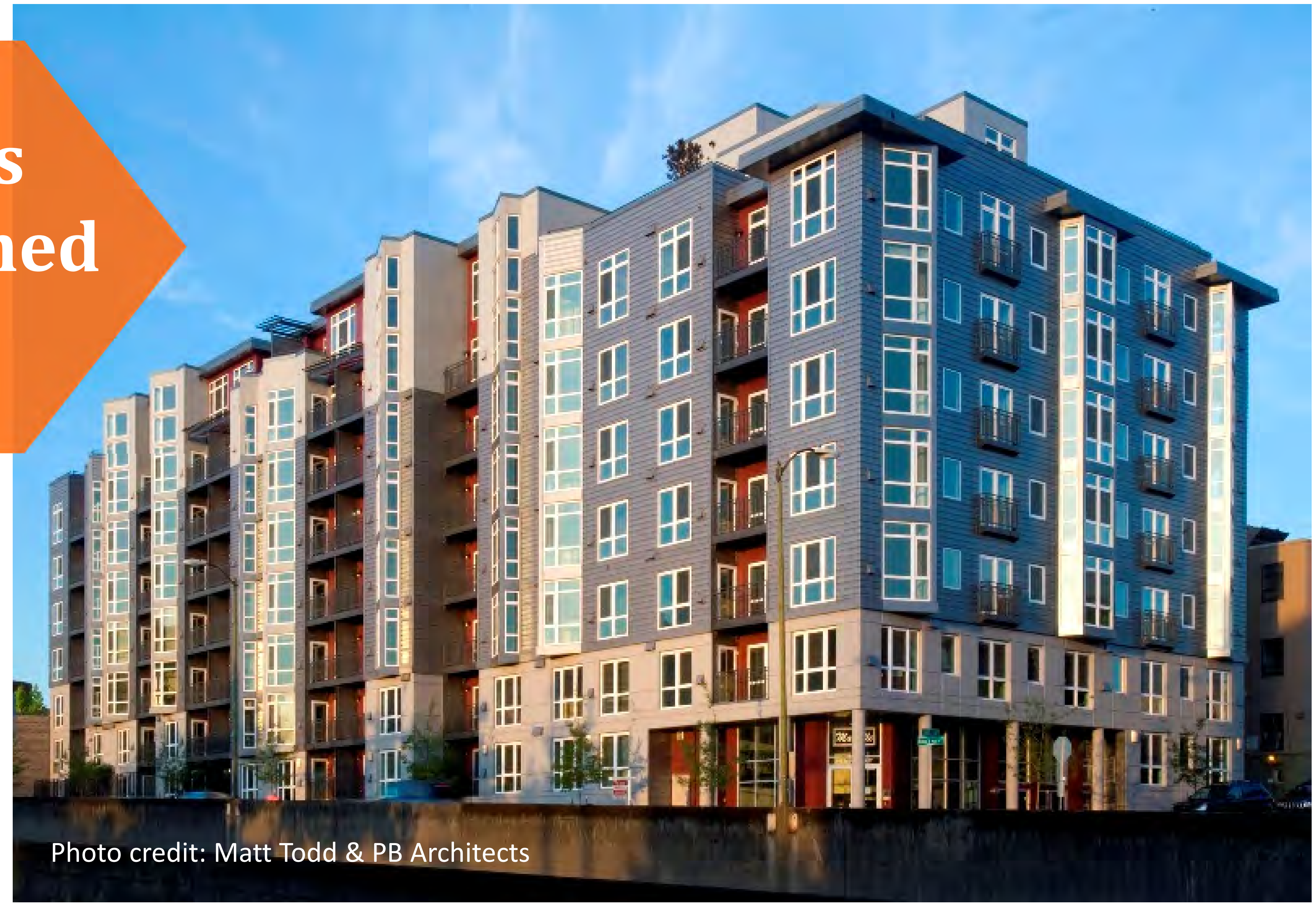


Photo credit: Matt Todd & PB Architects

Wood Mid-Rise Construction

6 stories for Offices,
5 stories for Residential
+ Mezzanine
+ Multi-Story Podium

Mid-Rise vs. High-Rise Definition – IBC 202

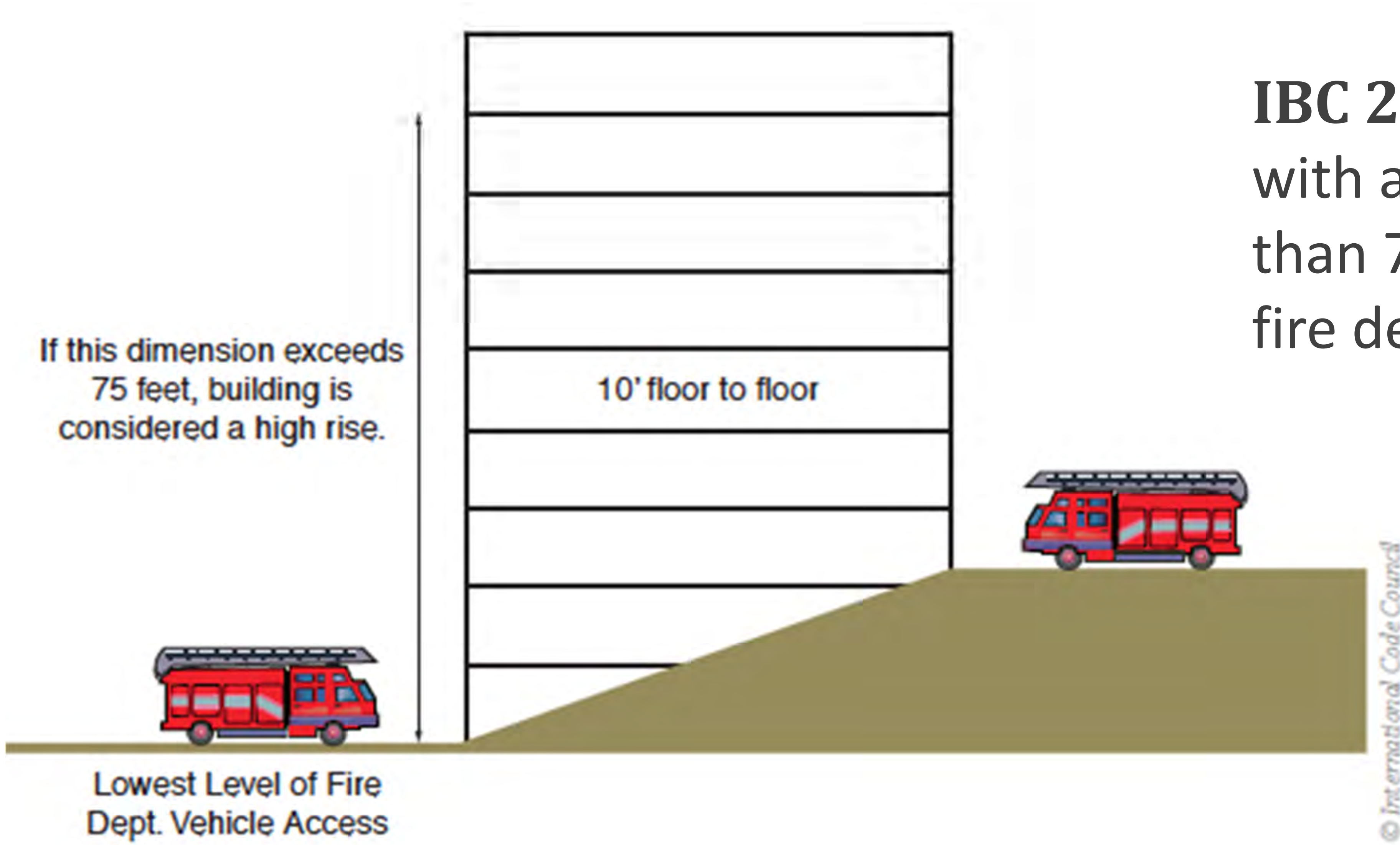


FIGURE 6-6 Determination of high-rise building

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.

Walk-up / Tuck Under

First floor walk up units with private garage

Benefits:

- Eliminates need for S-2 parking garage
- Can be all wood
- Least expensive overall but lowest densification rates (20-30 unites/acre)

Wrap-Around

Walk up units surround parking structure

Benefits:

- » Enhanced security
- » Centralized access to parking
- » Visual appeal from street
- » More expensive than walk/up tuck-under
- » 5 story yields 60-80 units/acre

Podium

Multiple stories of wood over an elevated concrete deck

Benefits:

- Increased number of stories
- Accommodates Mixed-use occupancies
- Most expensive but can allow increased density

Podium

4 stories of residential over podium (parking or retail)

» 60–80 units/acre

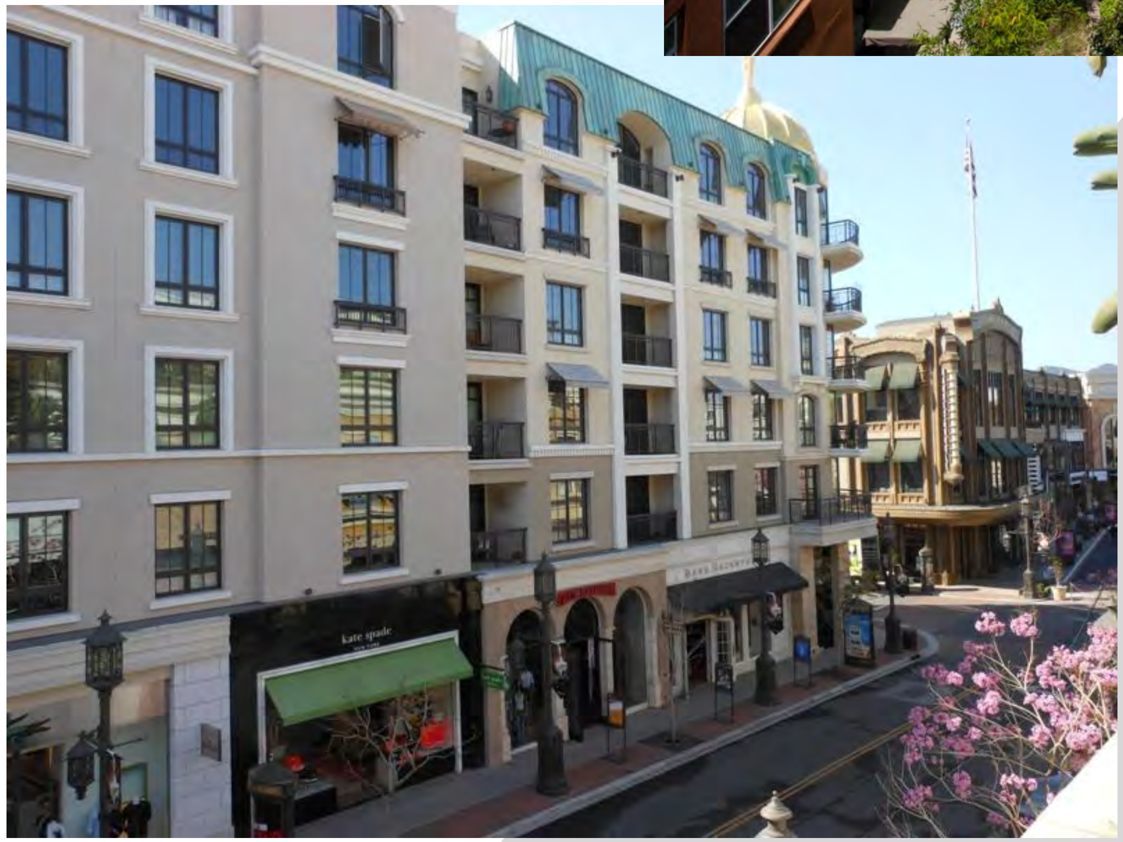
Inman Park Condos, Atlanta, GA
Davis & Church

Podium

5 stories over retail

» 100–120 units/acre

AvalonBay Stadium, Anaheim, CA
VanDorpe Chou Associates



Inman Park Condos, Atlanta, GA
Davis & Church

Podium

5 stories over residential podium

» 120–140 units/acre

16 Powerhouse, Sacramento, CA
D&S Development
LPA Sacramento

Mezzanine & Podium

5 stories with mezzanine + residential podium

» 125–145 units/acre

120 Union, San Diego, CA
Togawa Smith Martin

Outline

» Context for Mid-Rise Construction

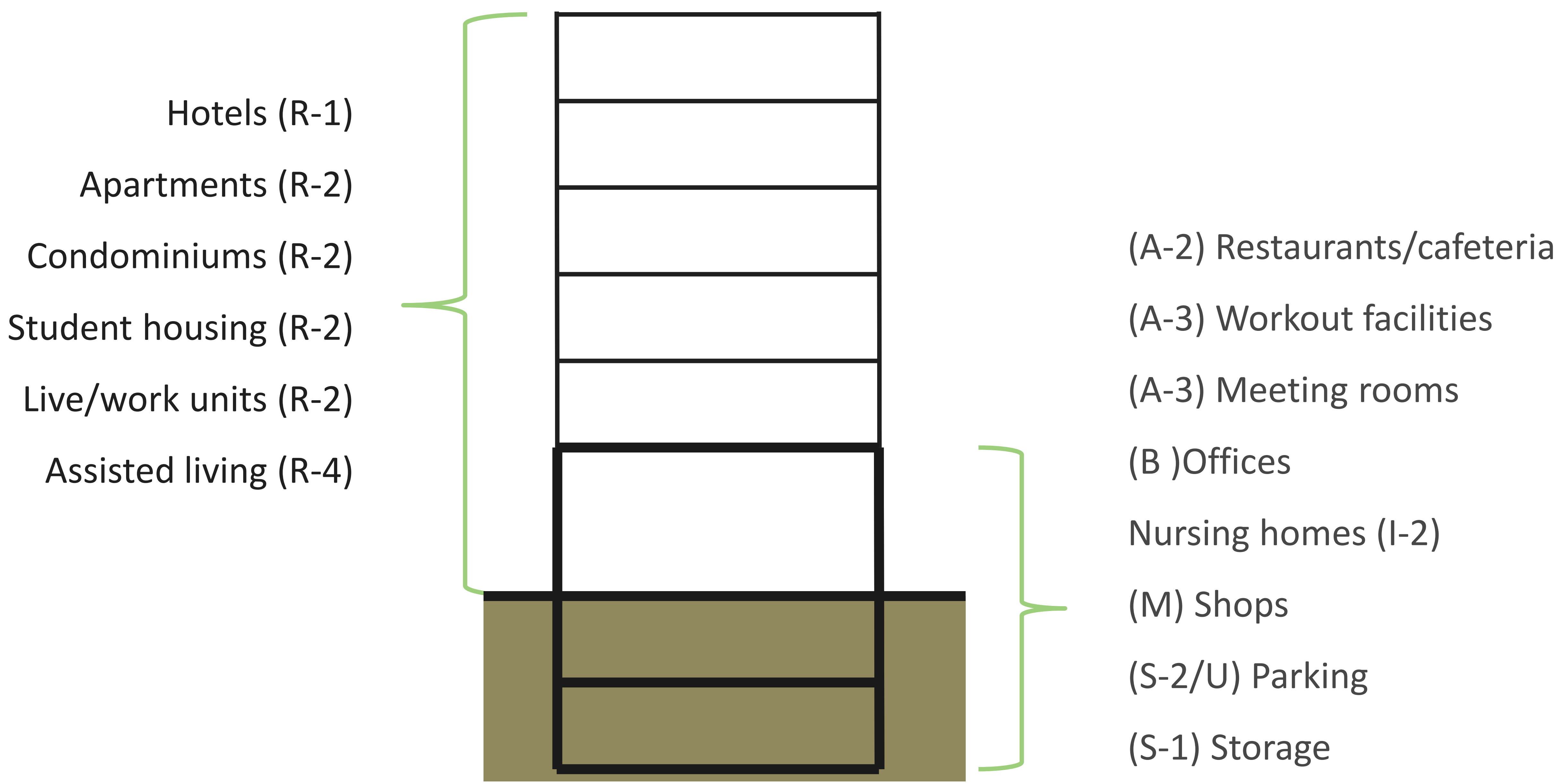
» Mid-rise Building Types/Configurations

» Maximizing Height & Area

1. Construction Types
2. Tabulate Areas & Stories
3. Allowable increases
4. Mezzanine & Special Design Provisions

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

Typical Mid-rise Occupancy



Mid-Rise 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

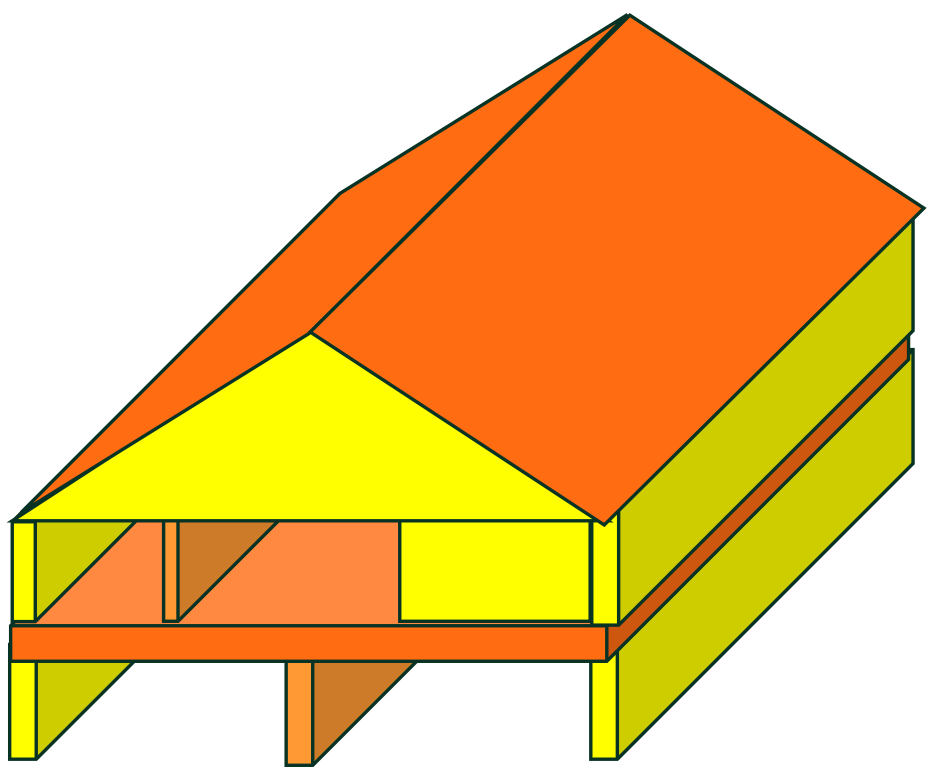
Types III and V can be subdivided to A (protected) or B (unprotected)

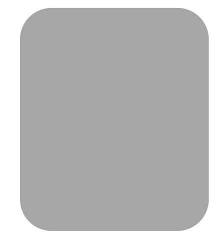
Type IV (Heavy Timber)

- Exterior walls non-combustible (may be FRTW)
- Interior elements qualify as Heavy Timber

Type III Construction

» Exterior walls are of noncombustible materials and interior building elements are of any material. Fire Retardant Treated (FRT) wood is permitted in exterior walls of 2hr fire rating or less.





Non-combustible

» Exterior walls

Fire Retardant Treated allowed

» Exterior walls if fire rating is 2hr or less

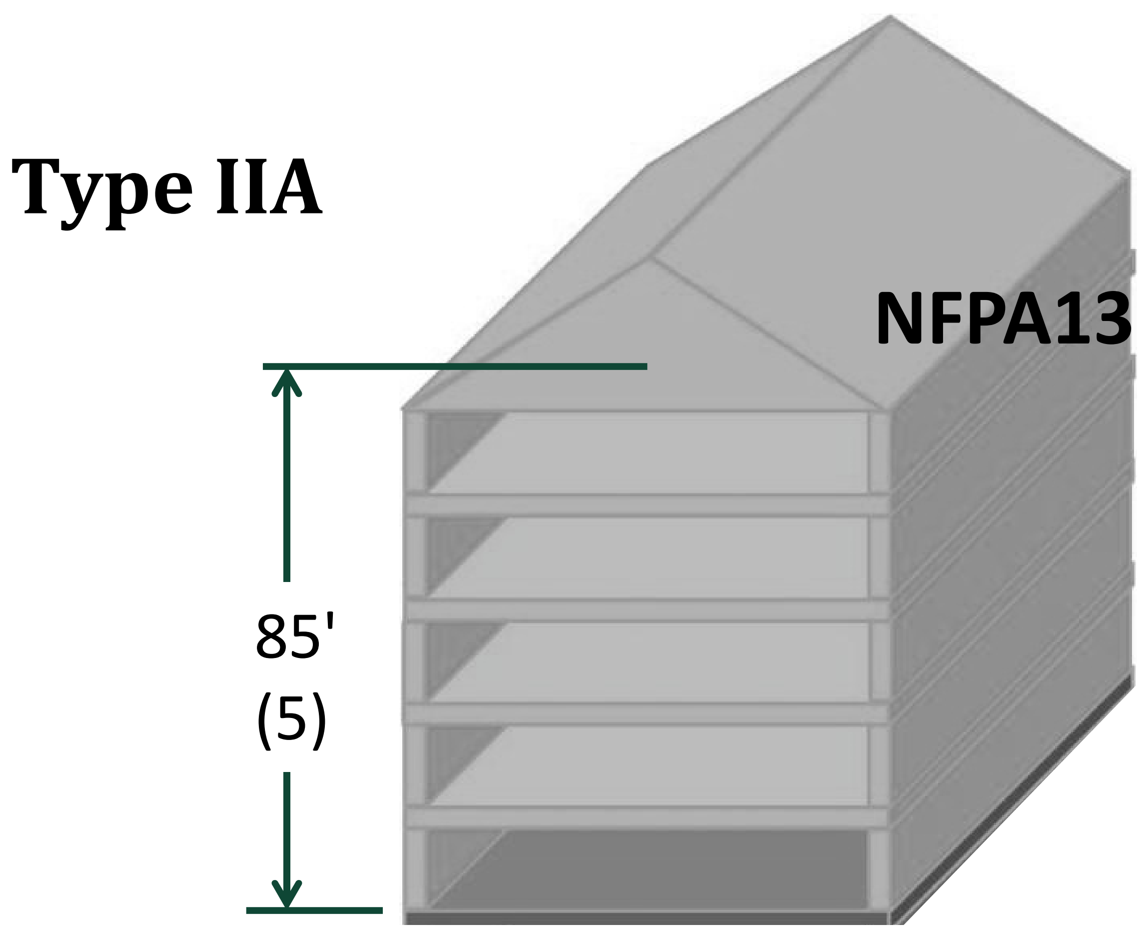
Heavy Timber

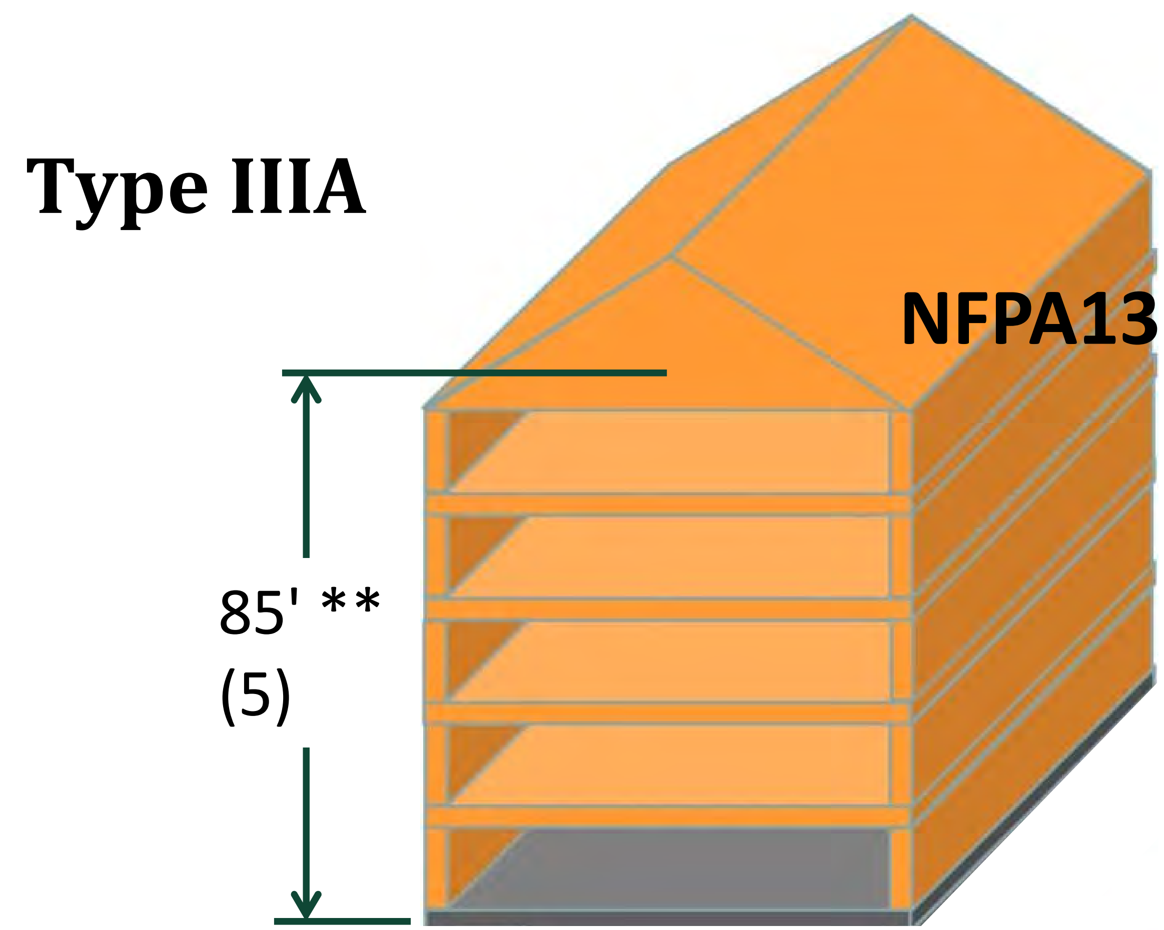
» HT used in place of 1 hr rating or less

Untreated Lumber

» All interior elements

Increased Height & Story Area





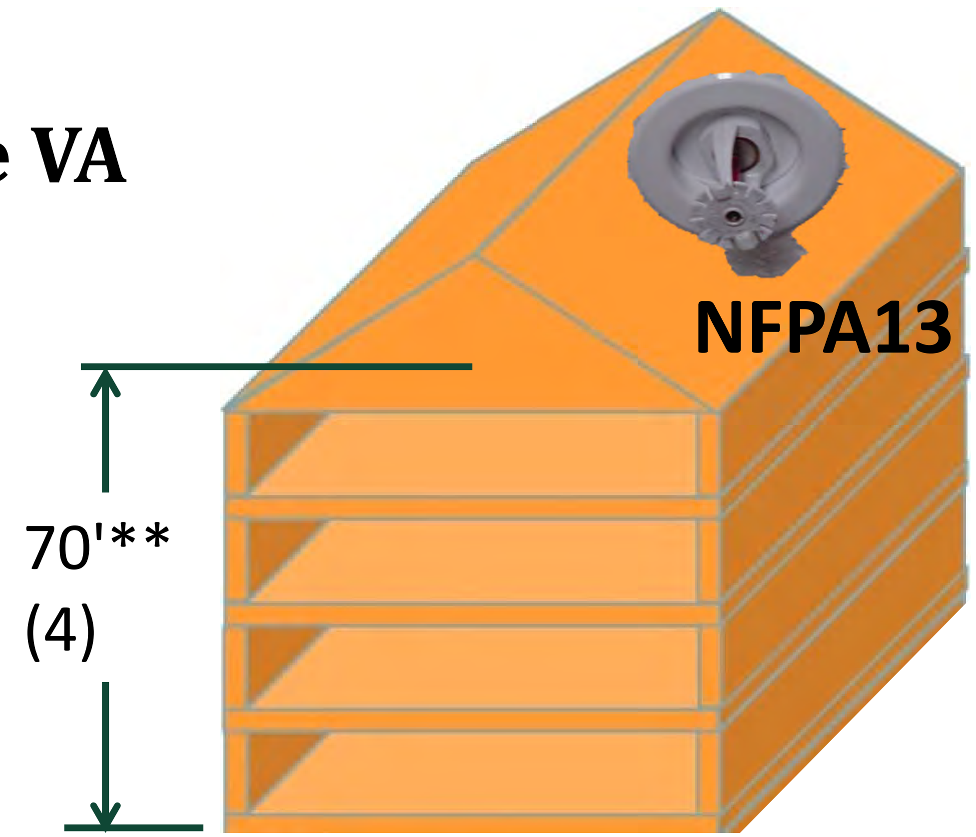
Occupancy	IIA (ft²)*	IIIA (ft²)*
R-1	72,000 +18,000 (max frontage)	72,000 +18,000 (max frontage)
R-2	72,000 +18,000 (max frontage)	72,000 +18,000 (max frontage)

* Areas reflect PER STORY max. Total building max may limit area further.

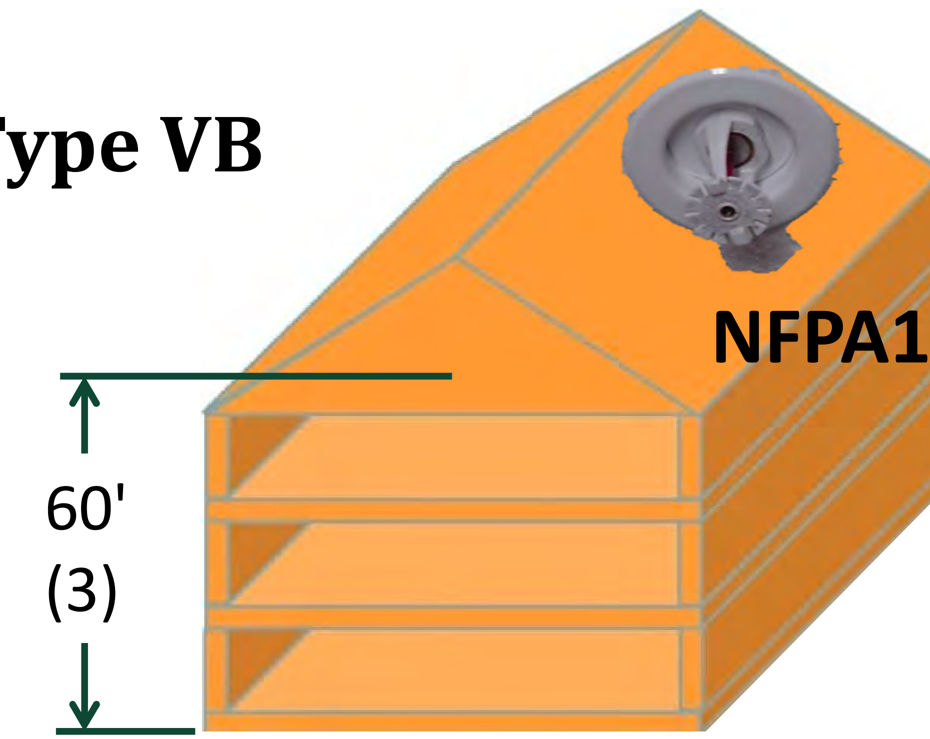
** ASCE7 12.2-1 limits wood shear wall seismic systems to 65' in height in SDC D,E,F

Opportunity for Office Occupancy (B)

Type VA



Type VB

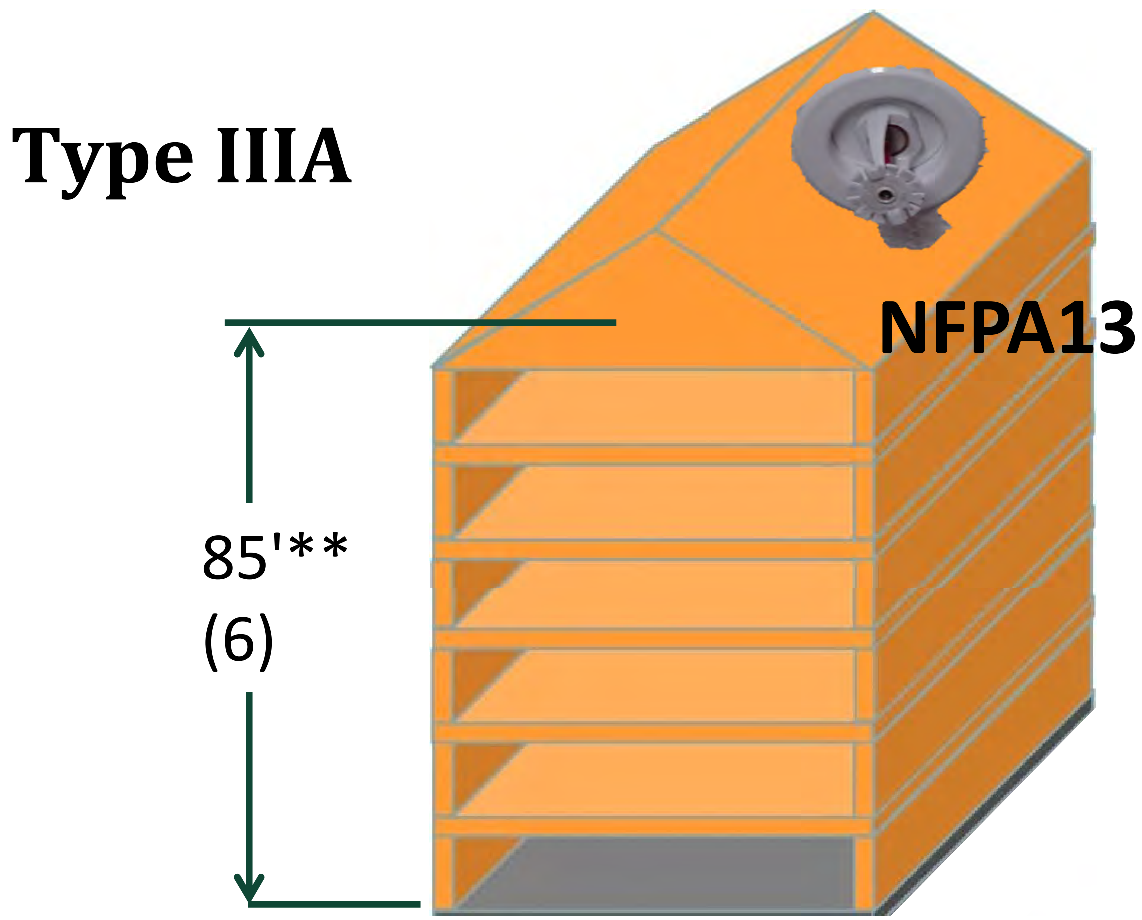


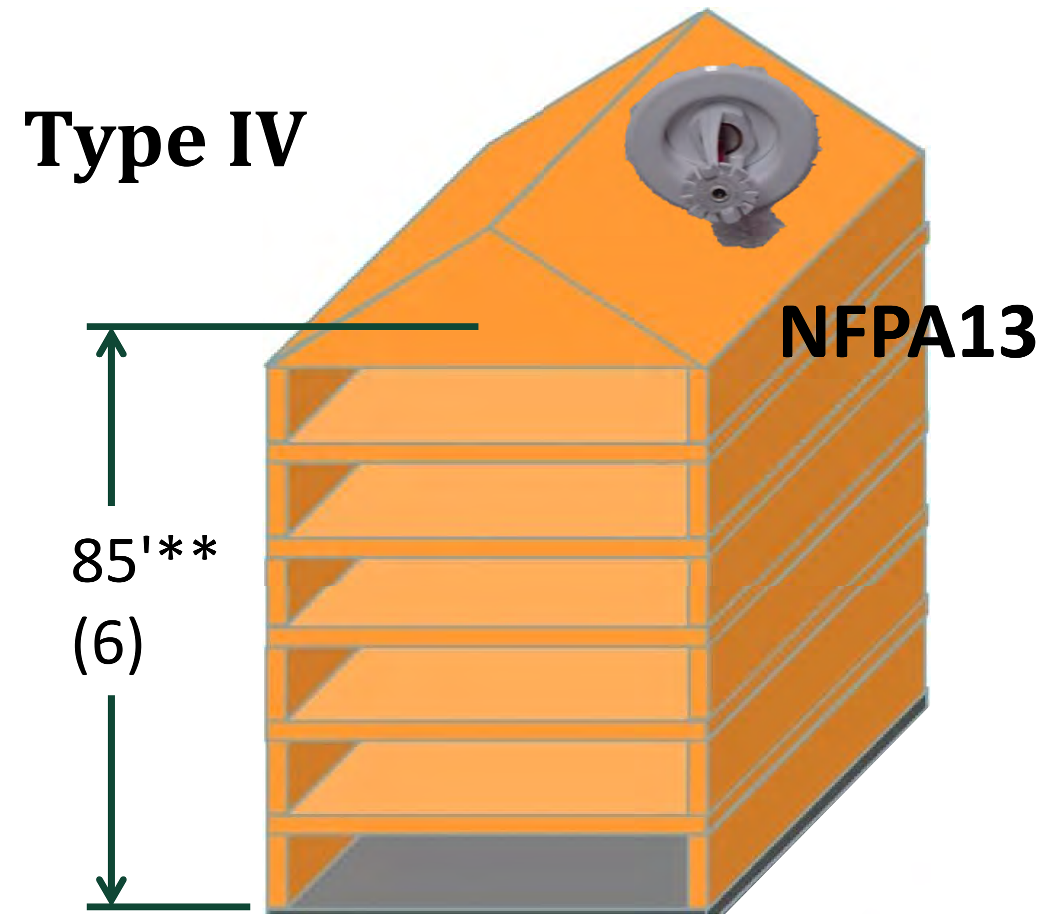
Occupancy	VA (ft^2)*	VB (ft^2)
R-1	36,000 +9,000(max frontage)	21,000 +5,250(max frontage)
R-2	36,000 +9,000(max frontage)	21,000 +5,250(max frontage)

* Areas reflect PER STORY max. Total building max may limit area further.

** ASCE7 12.2-1 limits wood shear wall seismic systems to 65' in height in SDC D,E,F

Opportunity for Residential Occupancy (R)





Occupancy	IIIA (ft^2)*	IV (ft^2)*
B	85,500 +21,375(max frontage)	108,000 +27,000(max frontage)

* Areas reflect PER STORY max. Total building max may limit area further.

** ASCE7 12.2-1 limits wood shear wall seismic systems to 65' in height in SDC D,E,F

Height – 2018 IBC Table 504.3

- **IBC 2018:** Table 504.3 provides base & increased heights

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
R	NS[d, h]	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)

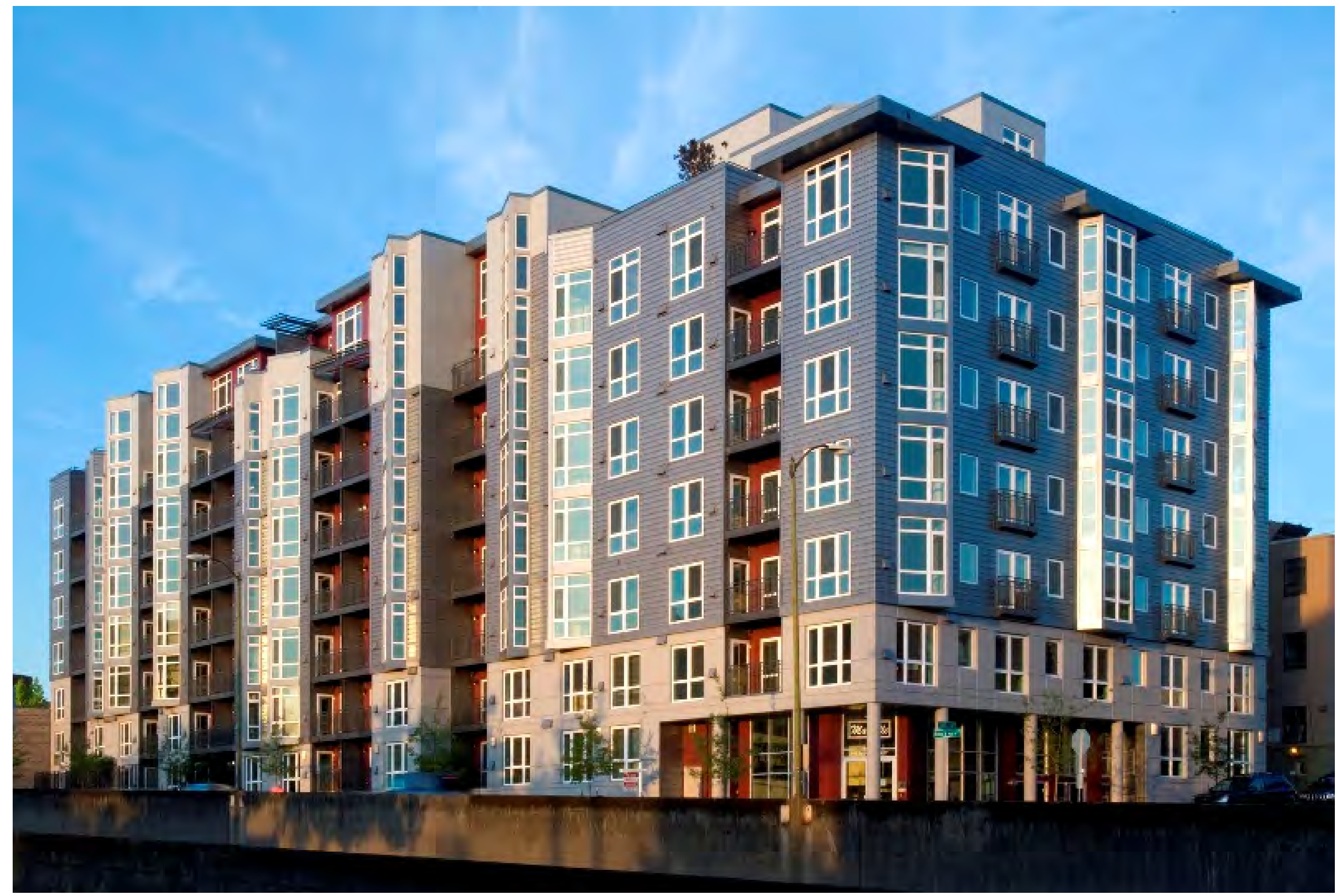
S13D (not shown) = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3 (NFPA 13D)

Stories – 2018 IBC Table 504.4

<table>
<tr><th rowspan="3">OCCUPANCY CLASSIFICATION</th><th colspan="10">TYPE OF CONSTRUCTION</th></tr>
<tr><th rowspan="2">SEE FOOTNOTES</th><th colspan="2">TYPE I</th><th colspan="2">TYPE II</th><th colspan="2">TYPE III</th><th>TYPE IV</th><th colspan="2">TYPE V</th></tr>
<tr><th>A</th><th>B</th><th>A</th><th>B</th><th>A</th><th>B</th><th>HT</th><th>A</th><th>B</th></tr>
<tr><td rowspan="2">A-2</td><td>NS</td><td>UL</td><td>11</td><td>3</td><td>2</td><td>3</td><td>2</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>S</td><td>UL</td><td>12</td><td>4</td><td>3</td><td>4</td><td>3</td><td>4</td><td>3</td><td>2</td></tr>
<tr><td rowspan="2">A-3</td><td>NS</td><td>UL</td><td>11</td><td>3</td><td>2</td><td>3</td><td>2</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>S</td><td>UL</td><td>12</td><td>4</td><td>3</td><td>4</td><td>3</td><td>4</td><td>3</td><td>2</td></tr>
<tr><td rowspan="2">B</td><td>NS</td><td>UL</td><td>11</td><td>5</td><td>3</td><td>5</td><td>3</td><td>5</td><td>3</td><td>2</td></tr>
<tr><td>S</td><td>UL</td><td>12</td><td>6</td><td>4</td><td>6</td><td>4</td><td>6</td><td>4</td><td>3</td></tr>
<tr><td rowspan="3">R-1</td><td>NS[d, h]</td><td>UL</td><td>11</td><td rowspan="2">4</td><td rowspan="2">4</td><td rowspan="2">4</td><td rowspan="2">4</td><td rowspan="2">4</td><td>3</td><td>2</td></tr>
<tr><td>S13R</td><td>4</td><td>4</td><td>4</td><td>3</td></tr>
<tr><td>S</td><td>UL</td><td>12</td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>4</td><td>3</td></tr>
<tr><td rowspan="3">R-2</td><td>NS[d, h]</td><td>UL</td><td>11</td><td>4</td><td rowspan="2">4</td><td rowspan="2">4</td><td rowspan="2">4</td><td rowspan="2">4</td><td>3</td><td>2</td></tr>
<tr><td>S13R</td><td>4</td><td>4</td><td>4</td><td>4</td><td>3</td></tr>
<tr><td>S</td><td>UL</td><td>12</td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>4</td><td>3</td></tr>
<tr><td rowspan="2">S-1</td><td>NS</td><td>UL</td><td>11</td><td>4</td><td>2</td><td>3</td><td>2</td><td>4</td><td>3</td><td>1</td></tr>
<tr><td>S</td><td>UL</td><td>12</td><td>5</td><td>3</td><td>4</td><td>3</td><td>5</td><td>4</td><td>2</td></tr>
</table>

Sloped Sites

Fashion Valley, CA
AvalonBay Communities



Seattle, WA
PB Architects

Sloped Sites – Chapter 2 Definitions

HEIGHT, BUILDING. The vertical distance from *grade plane* to the average height of the highest roof surface.

GRADE PLANE. A reference plane representing the average of finished ground level adjoining the building at *exterior walls*. Where the finished ground level slopes away from the *exterior walls*, the reference plane shall be established by the lowest points within the area between the building and the *lot line* or, where the *lot line* is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

626 Dekalb Avenue, Atlanta, GA
Matt Church - Davis Church Structural Engineers

Basements – 2018 IBC 506.1.3

A basement is not included in the total allowable building area if it doesn't exceed the area permitted for a building with no more than one story above grade plane.

"Basement" is defined as "not a story above grade plane" and has a finished floor surface:

- Less than 6 feet above grade plane; or
- Less than 12 feet above the finished ground level at any point

Fashion Valley, CA
AvalonBay Communities

Summary of Building Heights

Building Heights and Stories by Building Type With NFPA 13 Sprinklers				
Occupancy	IIIA	IIIB	VA	VB
	85 ft	75 ft	70 ft	60 ft
R-1/R-2/R-4	5	5	4	3
A-2/A-3	4	3	3	2
B	6	4	4	3
M	5	3	4	2
S-2	5	4	5	3
S-1	4	3	4	2

**ASCE7 12.2-1 limits wood shear wall seismic systems to 65’ in height in SDC D,E,F

Area Increases – IBC 2018

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
R-1	NS[d, h]	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)

Sprinkler Systems: 2018 IBC 903.2

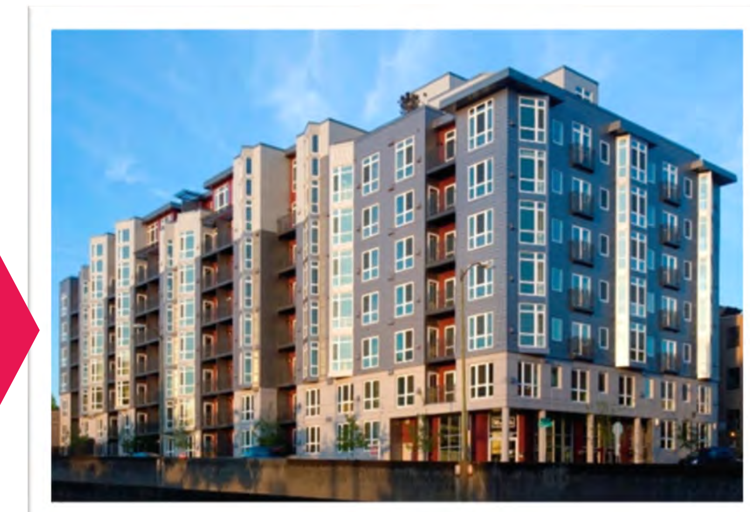
In some cases, sprinklers are required by code depending on occupancy

- Most new Group R fire areas
- Group A, E, M, S-1, I fire areas exceeding 1-12k sf

Stella Apartments, DesignARC, Taylor and Syfan, photo Lawrence Anderson

Commercial Sprinkler Systems – IBC 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 (but allowed in a few commercial occupancies) 903.3.1.3



NFPA 13 vs. NFPA 13R

NFPA 13	NFPA 13R
Goal: Provide life safety and property protection	Goal: Provide life safety only
Fully sprinklered system throughout entire building even in unoccupied spaces (closets, attics)	Partially sprinklered system; unoccupied spaces often don't require sprinklers
Can cost more	Lower levels of water discharge, shorter water supply time can result in smaller pipe sizes, reduce need for storage & pumps
Permitted for many occupancies, buildings of many sizes, allows greater building size increases	Limited applications, mainly for multi-family up to 4 stories, 60 feet

Single Occupancy, 1 Story – 506.2.3

$$A_a = A_t + \boxed{[NS \times I_f]}$$

(Equation 5-1)

A_a = Allowable area per story (sq. ft.)

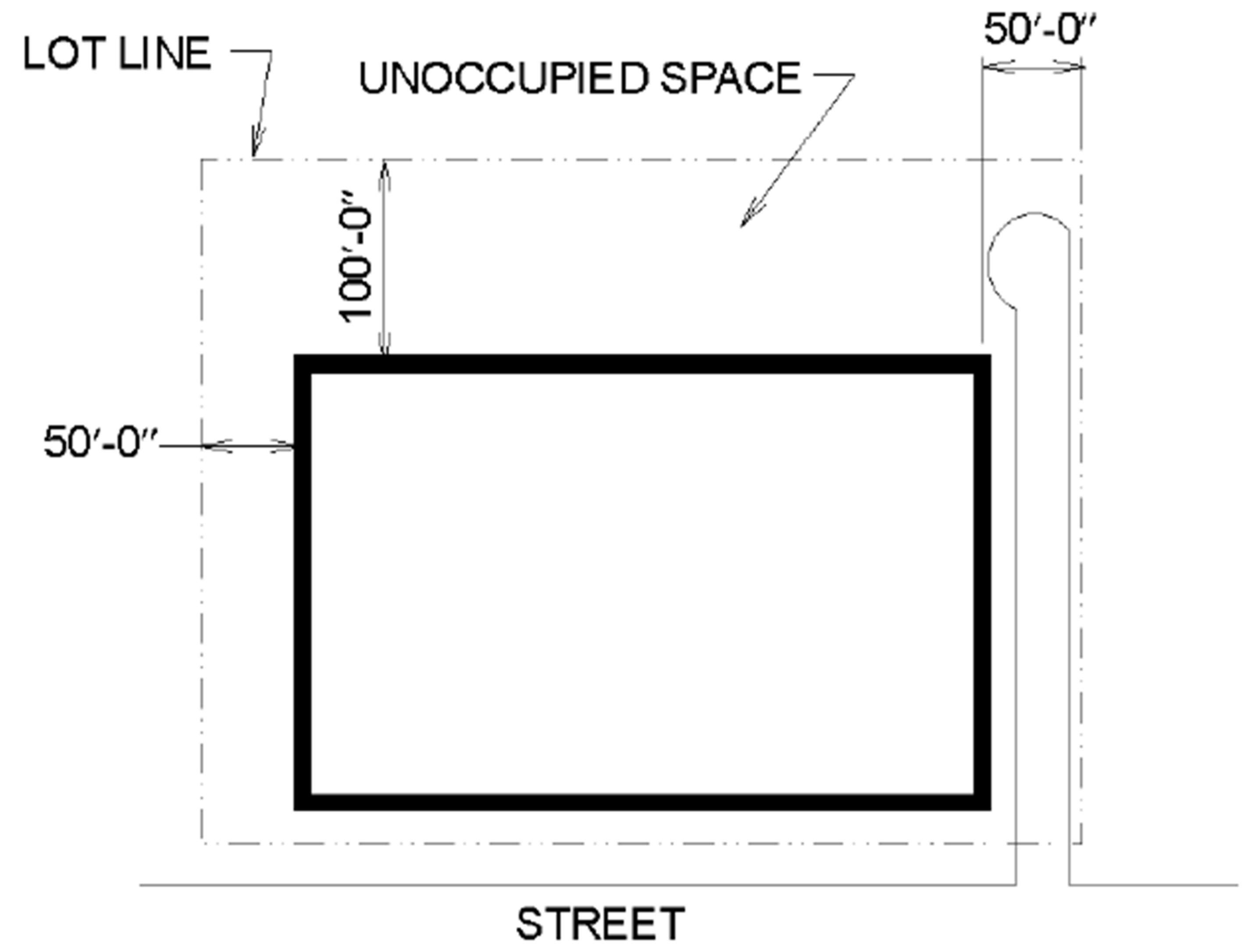
A_t = Tabular allowable area per story per Table 506.2 for NS, S1 or S13R (sq. ft.)

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

I_f = Area increase factor due to frontage per 506.3
$I_{f,\,max} = 0.75$

Area Modification – Frontage IBC 506.3

The allowable area of a building is permitted to be increased when it has a certain amount of frontage on streets (public ways) or open spaces, since this 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 and from adjacent structures.



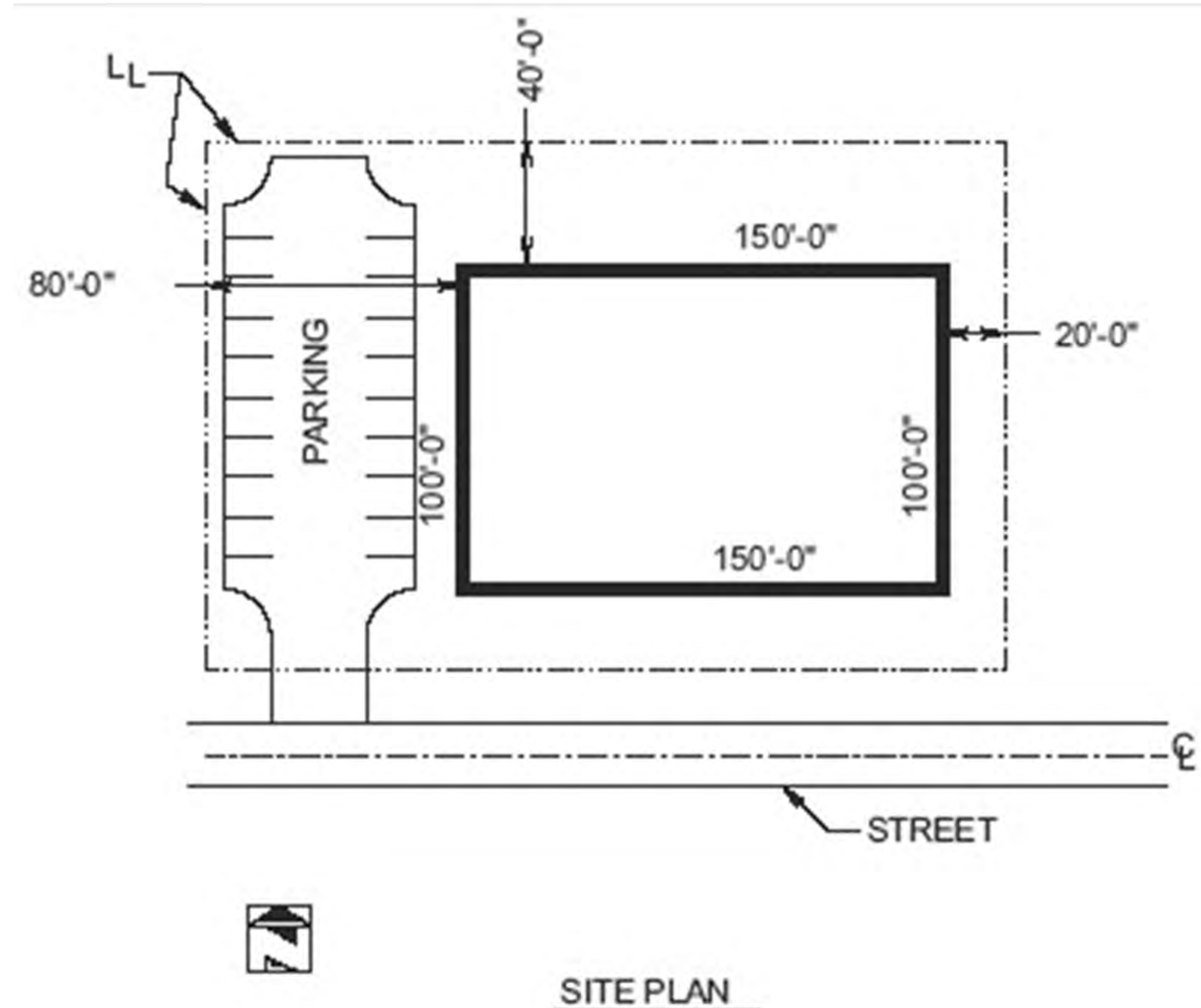
Frontage Increases – IBC 506.3.3

$$I_f = [F/P - 0.25]W/30$$

(IBC Equation 5-5)

WHERE:

- I_f = Area increase due to frontage
- F = Building perimeter that fronts on a public way or open space having 20 feet open minimum width
- P = Perimeter of entire building
- W = Width of public way or open space (feet) in accordance with section 506.3.2



Area Modification – Frontage IBC 506.3

MINIMUM QUALIFICATIONS

25% min of building perimeter is on a public way or open space 20' min distance from building face to:

- Closest interior lot line
- Entire width of public way
- Exterior face of adjacent building

EXCEPTIONS

Where building meets Unlimited requirements of IBC 507

And $W > 30'$

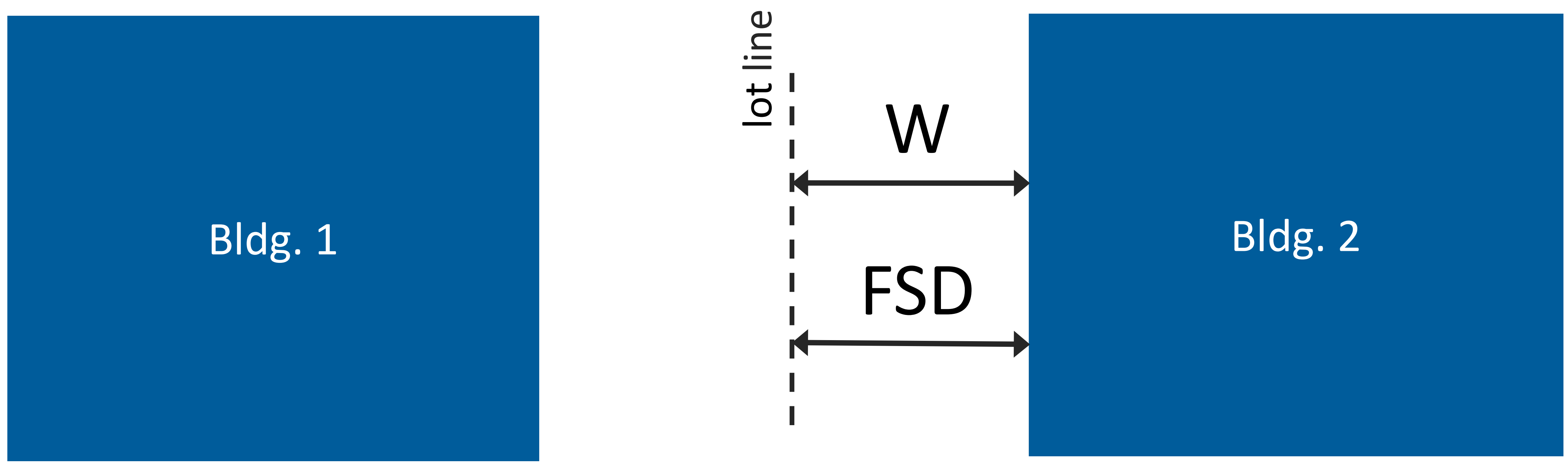
$W_{max} = 60'$

Frontage Increases – IBC 506.3.2

"W" for area increases is NOT always the same as Fire Separation Distance for purposes of fire resistance ratings of walls and openings

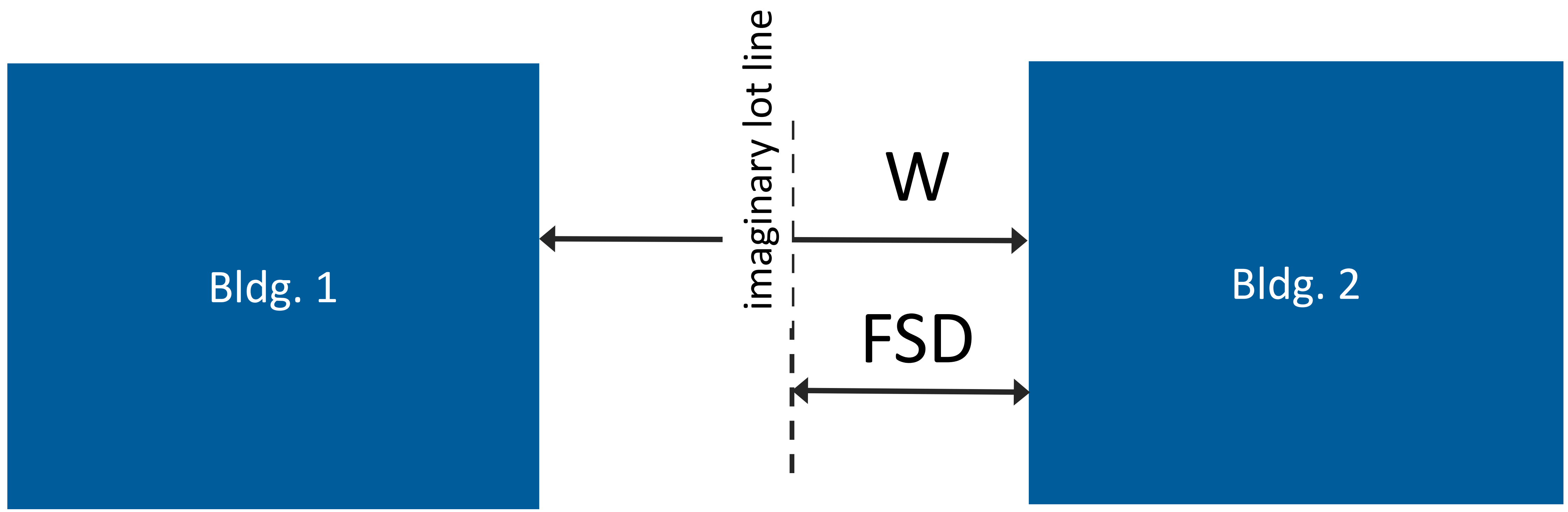
Frontage Increases – IBC 506.3.2

For two buildings on DIFFERENT lots



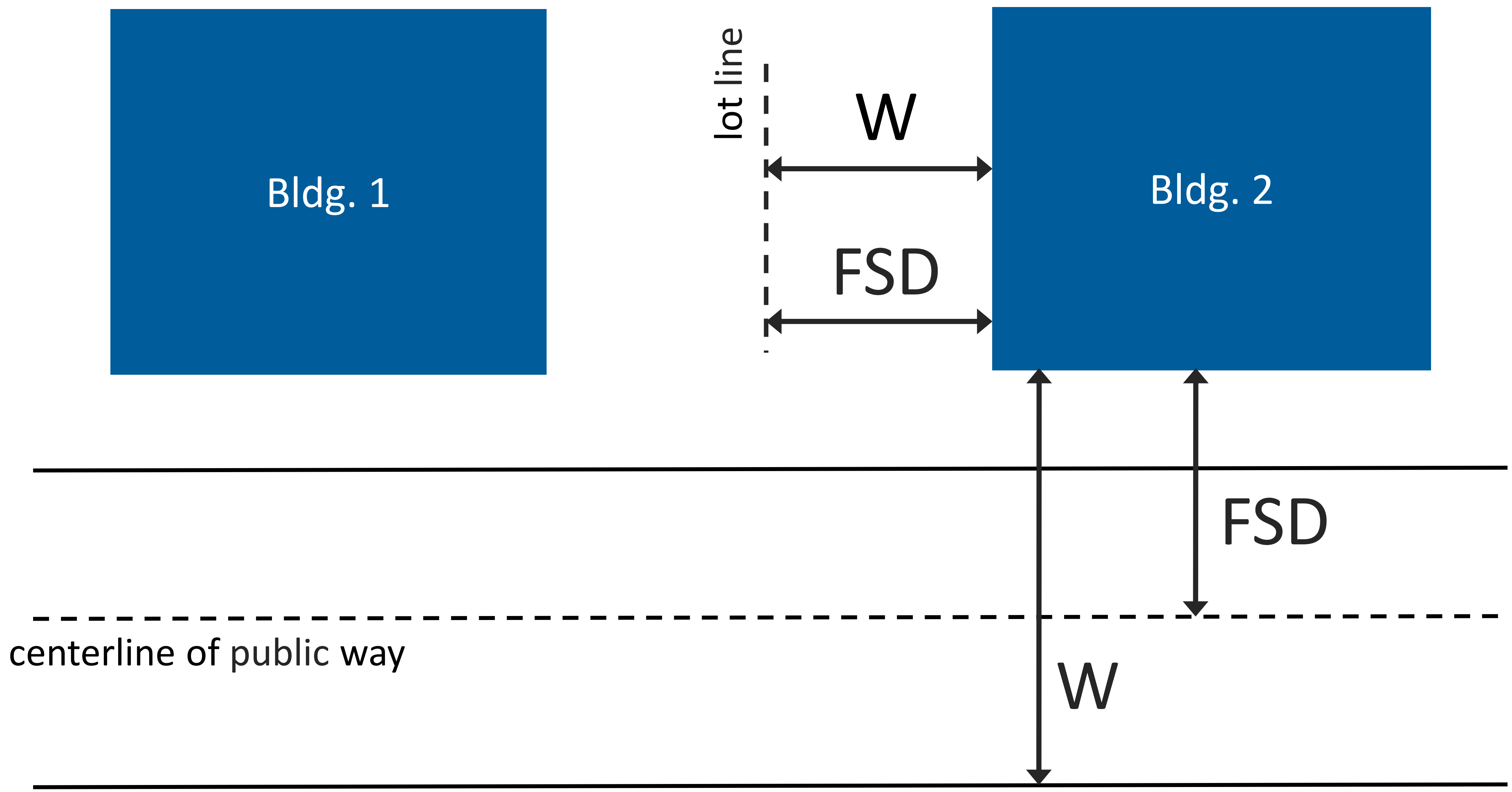
Frontage Increases – IBC 506.3.2

For two buildings on DIFFERENT lots



Frontage Increases – IBC 506.3.2

Buildings near public right of ways:



Frontage Increases – IBC 506.3.3

$$W = [(L_1 \times w_1) + (L_2 \times w_2) + (L_3 \times w_3)....]/F$$

(IBC Equation 5-4)

WHERE:

W = Calculated Width (weighted average) of public way or open space (feet)

L_n = Length of a portion of the exterior perimeter wall

w_n = Width (≥ 20 ft) of public way or open space associated with that portion of the exterior perimeter wall

F = Building perimeter that fronts on a public way or open space having 20 feet open minimum width

Total Building Area – 2018 IBC 506.2.3

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

(Equation 5-2)

A_a = Allowable area per story (sq. ft.)

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

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

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

S_a = Actual number of building stories above grade

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

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

Total Building Area – 2018 IBC 506.2.3

1 story building

» Total Area is 1x A_a

R-2
S13R

24K

R-2
SM

96K

Total Building Area – 2018 IBC 506.2.3

2 story building

» Total Area is 2x A_a

Total Building Area – 2018 IBC 506.2.3

3 story building

- Total Area is 3x A_a
- Frontage Increase is included in A_a

R-2
S13R + I_f (NS)

24K +	.75(24K)
24K +	.75(24K)
24K +	.75(24K)

R-2
SM + I_f (NS)

72K +	.75(24K)
72K +	.75(24K)
72K +	.75(24K)

Total Building Area – 2018 IBC 506.2.3

4 story IIIA building

- Total Area is 3x A_a for NFPA 13
- Total area is 4x A_a for NFPA 13R

R-2S13R	R-2SM
24K	~~72K~~ 54K (no frontage) 67.5K (full frontage)
24K	~~72K~~ 54K (no frontage) 67.5K (full frontage)
24K	~~72K~~ 54K (no frontage) 67.5K (full frontage)
24K	~~72K~~ 54K (no frontage) 67.5K (full frontage)

Mixed Occupancy, Multi-story

Story Area: $\Sigma[A_t + (NS \times I_f)]/A_a \leq 1$

(Described in 508.4.2)

Total Building Area: $\Sigma[A_t + (NS \times I_f)]/A_a \leq S_a$

(Described in 506.2.4)

$\mathbf{A_a}$ = Allowable area per story (sq. ft.)

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

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

$\mathbf{I_f}$ = Area increase factor due to frontage per 506.3
I_f, max = 0.75

$\mathbf{S_a}$ = Actual number of building stories above grade

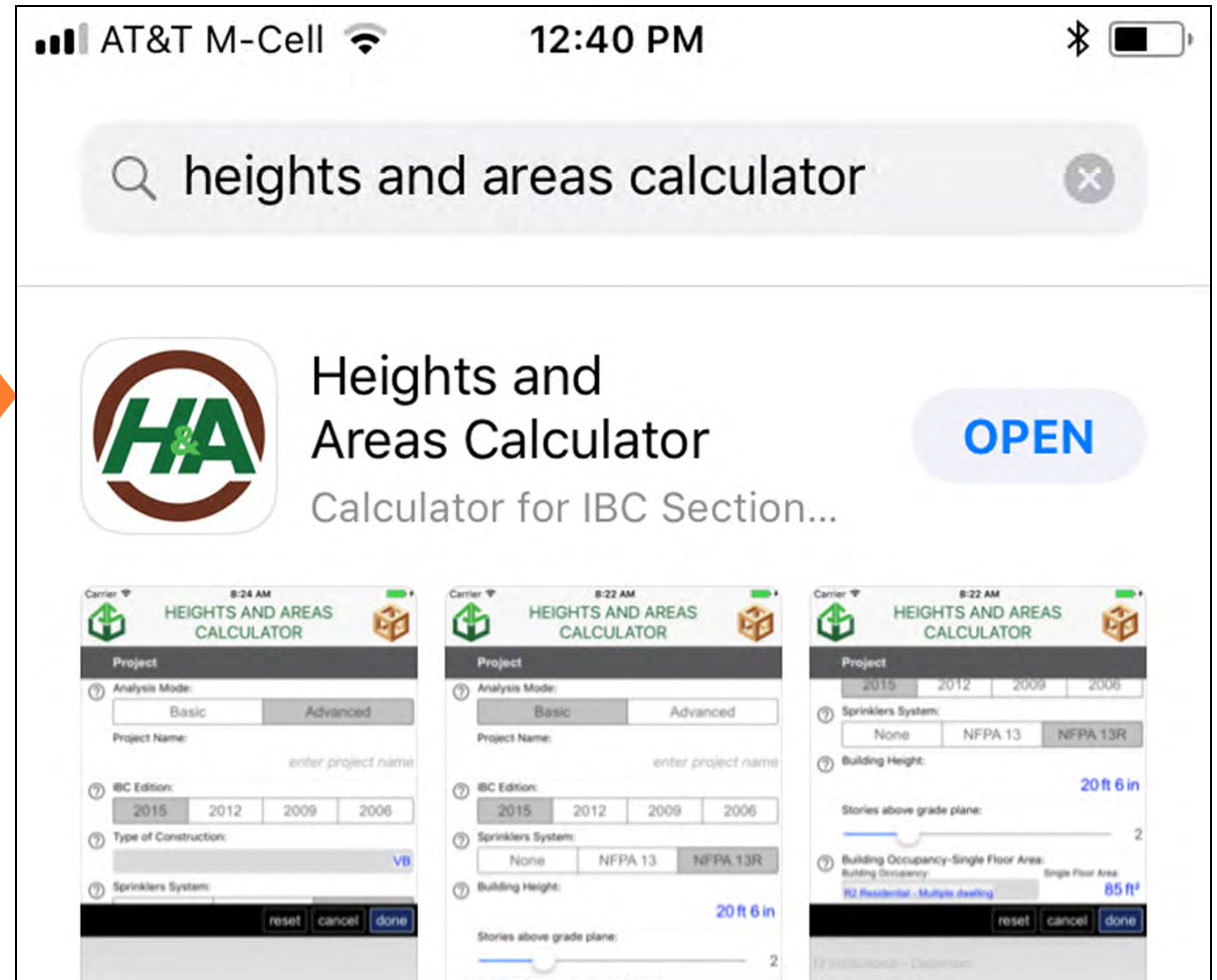
$\mathbf{S_{a,\,max}}$ = 3 for non-sprinklered buildings and those w/ NFPA13

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

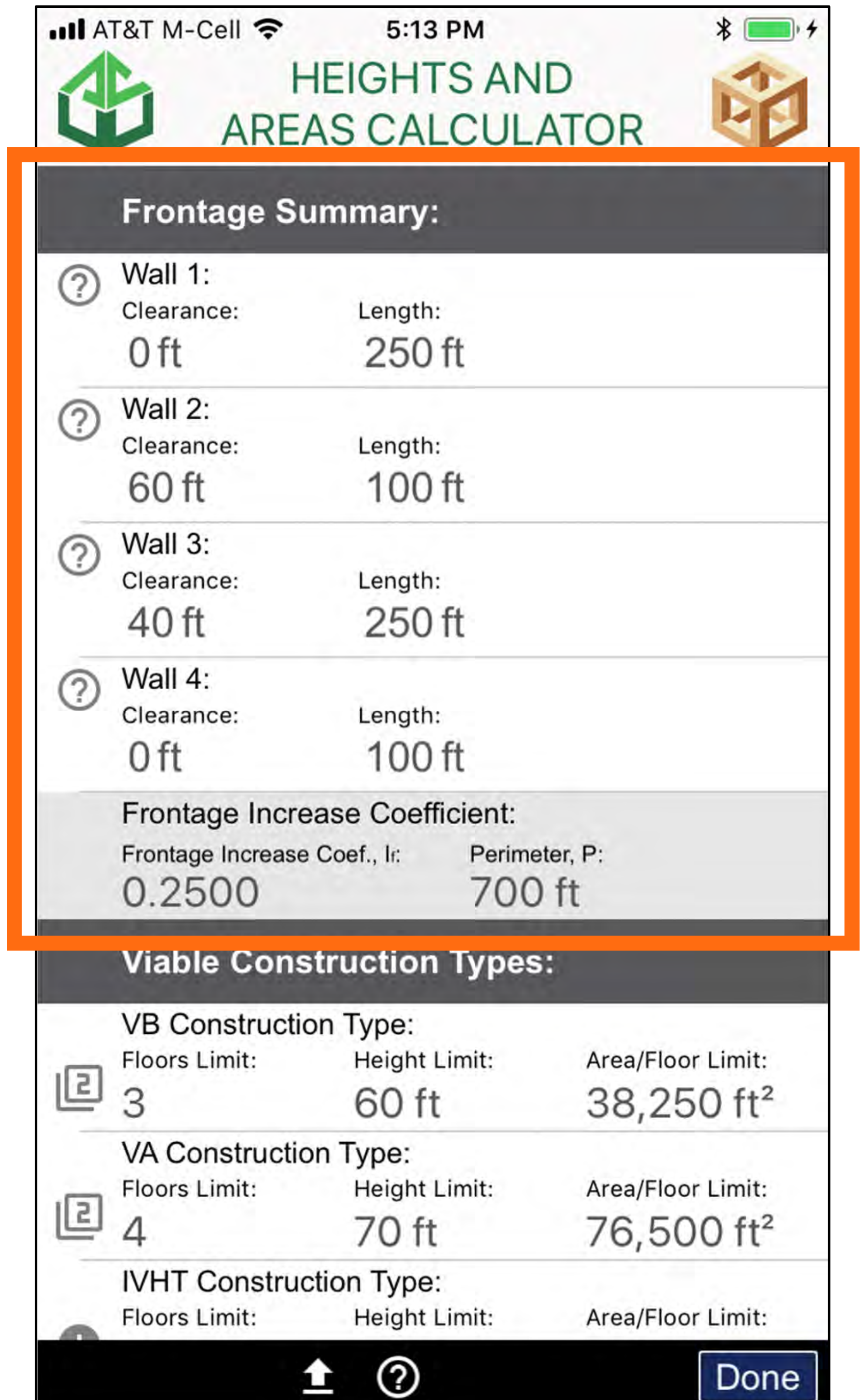
Mixed Use Occupancy – Design Aid

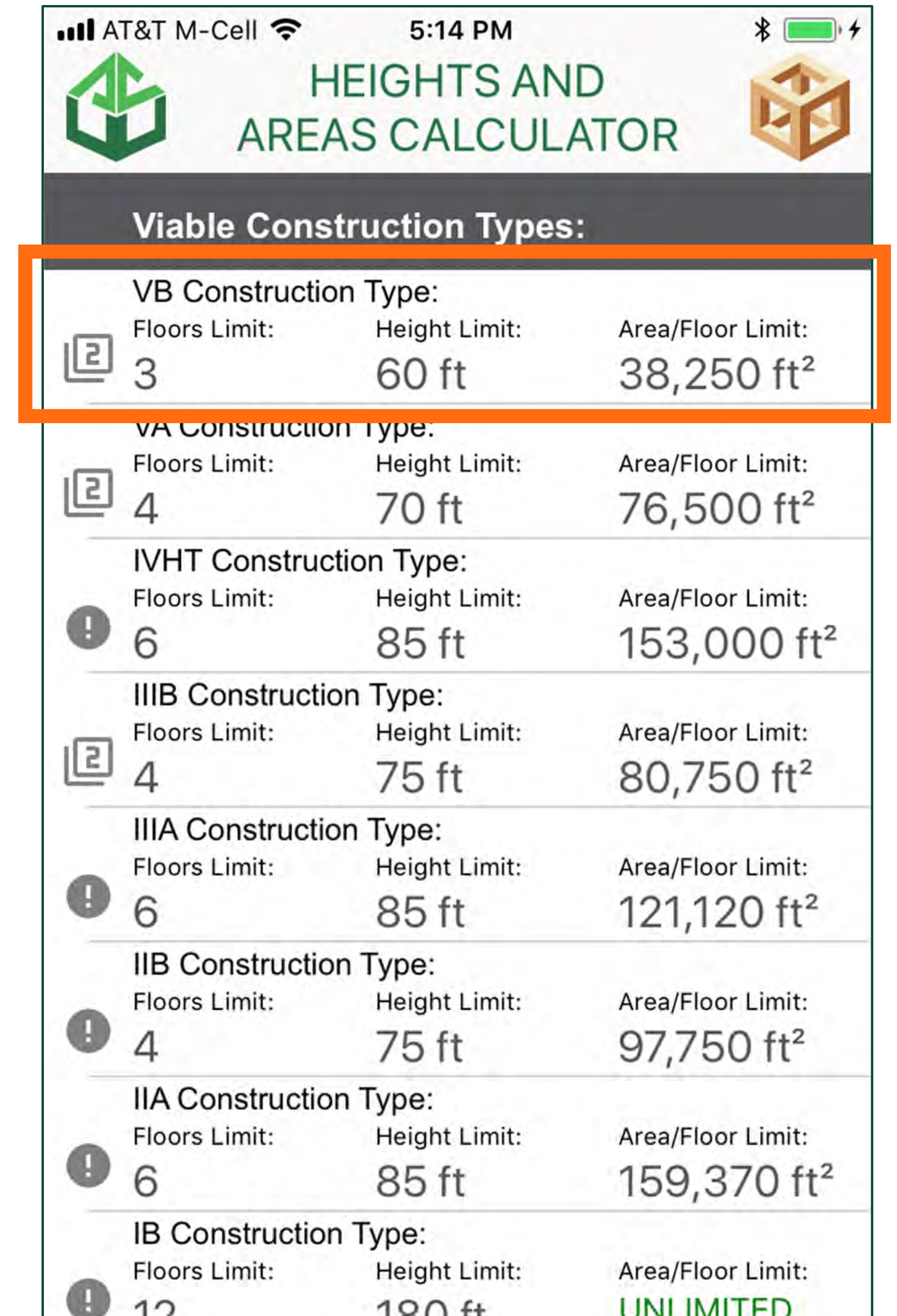
WoodWorks/AWC Heights & Areas Calculator App

Based on 2015 IBC
Available for FREE at
woodworks.org



Frontage Calculation – Design Aid





Case Study Innovations in Wood

Emory Point Atlanta, GA

- 3 buildings complete – Luxury Apt., retail, restaurants
- (1) 5 story Type III wood frame over slab on grade
- (2) 4 stories of wood over 1 story concrete podium

35% Structure Savings

- $14/sf (wood concept)
- $22/sf (PT conc. Slab and frame)

Architect: Cooper Carry, The Preston Partnership

Engineer: Ellinwood + Machado, Pruitt Eberly Stone

Contractor: Fortune-John

Photo credit: Gables Residential

Mezzanines – 2018 IBC 505

Not counted toward building area* or number of stories if:

- Maximum 1/3 floor area of *room* or *space* where located
- Special egress provisions apply
- Must be open and unobstructed to room in which it's located (walls ≤ 42" allowed)
  - Several exceptions
- Slightly different for equipment platforms

*Does count toward fire area with regard to fire protection in Chapter 9

Case Study Maximizing View and Value With Wood

Marselle Condominiums

Seattle, WA

- Type IIIA condo complex
- 5 -1/2 stories of wood over 2 stories of concrete
- Mezzanine added $250K cost but $1M in value
- 30% cost saving over concrete
- Time savings over steel

Architect: PB Architects

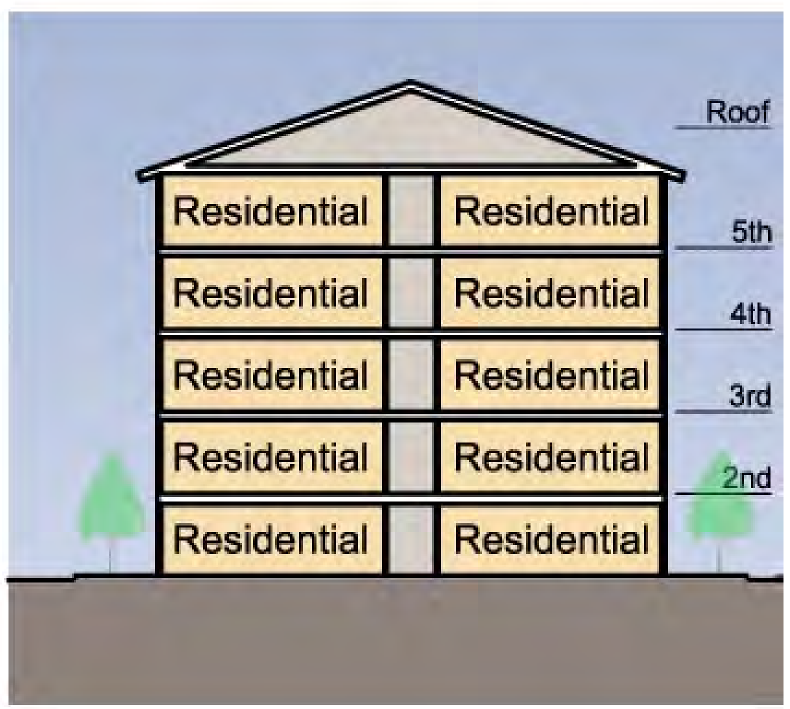
Engineer: Yu & Trochalakis

Contractor: Norcon, NW

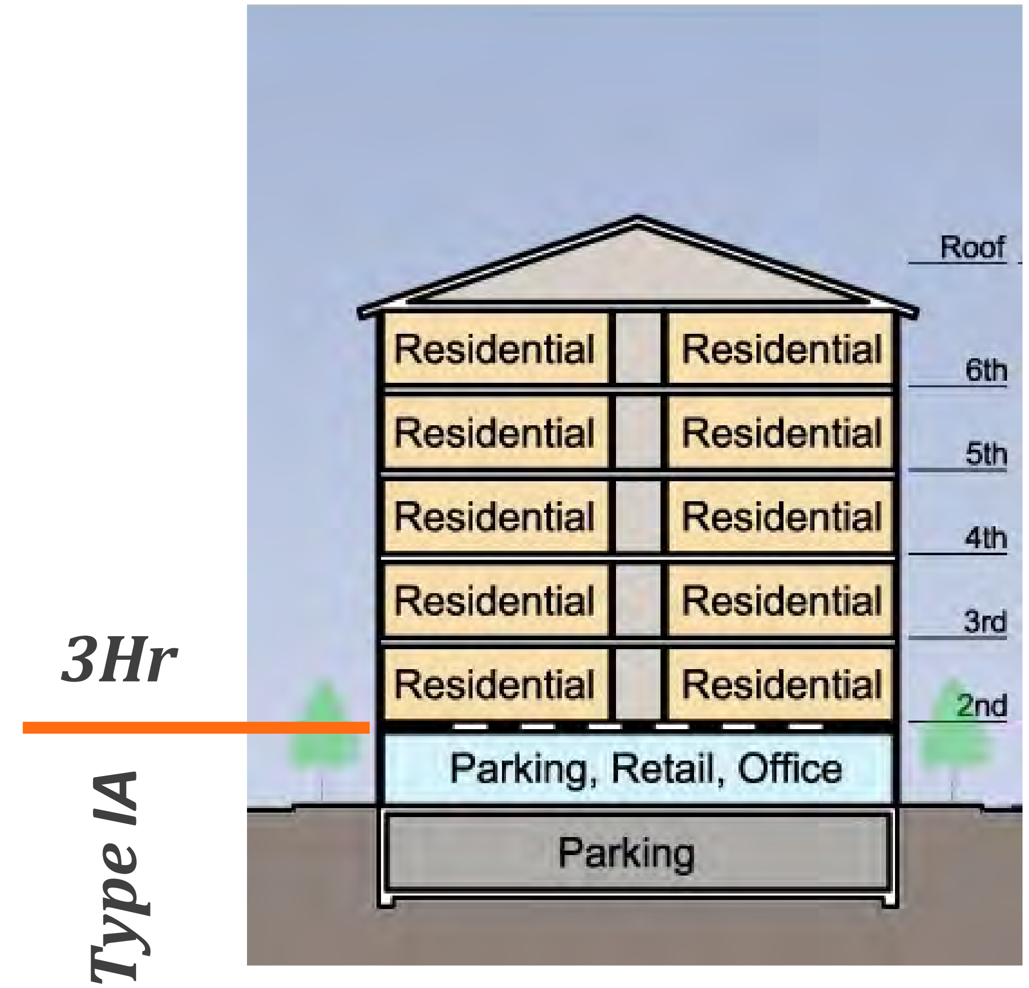
Completed: 2009

Photo Credit: Matt Todd Photography

IBC Podium Provisions



5 story Type III Building



5 story Type III Building
On Top of a Type IA Podium

Special Provisions for Podiums in IBC 510.2
Increases allowable stories… not allowable building height

Horizontal Building Separation – 510.2

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

- Overall height is still limited to min of either building
- 3hr rated horizontal assembly
- Building below is Type 1A with sprinklers
- Enclosures penetrating horizontal assembly are 2hr rated
- Occupancy above is A (occupant load <300), B, M, R or S
- Occupancy below is any except H

The Flats at ISU, Normal, IL
OKW Architects
Precision Builders & Associates

Case Study Wood Buildings Aim High

Inman Park Condominiums

Atlanta, GA

Architect: Brown Doane Architects

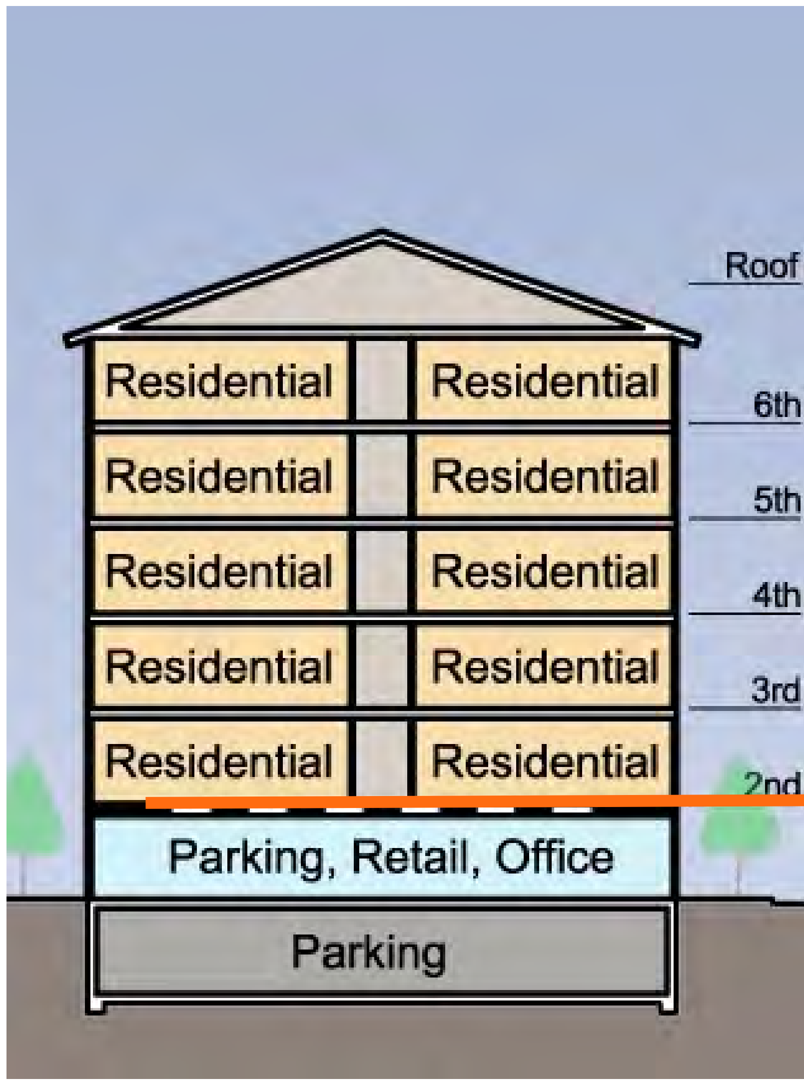
Engineer: Davis & Church

4 stories of wood over 2 stories of concrete parking

Floor joists selected to maximize headroom and not exceed building height (10' ceilings)

Drop ceilings for MEP at perimeter of some rooms

Evolution of IBC Mixed-Use Podium



3Hr

Type IA

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			No Restriction	

IBC Provisions for mixed-use podiums have been evolving.

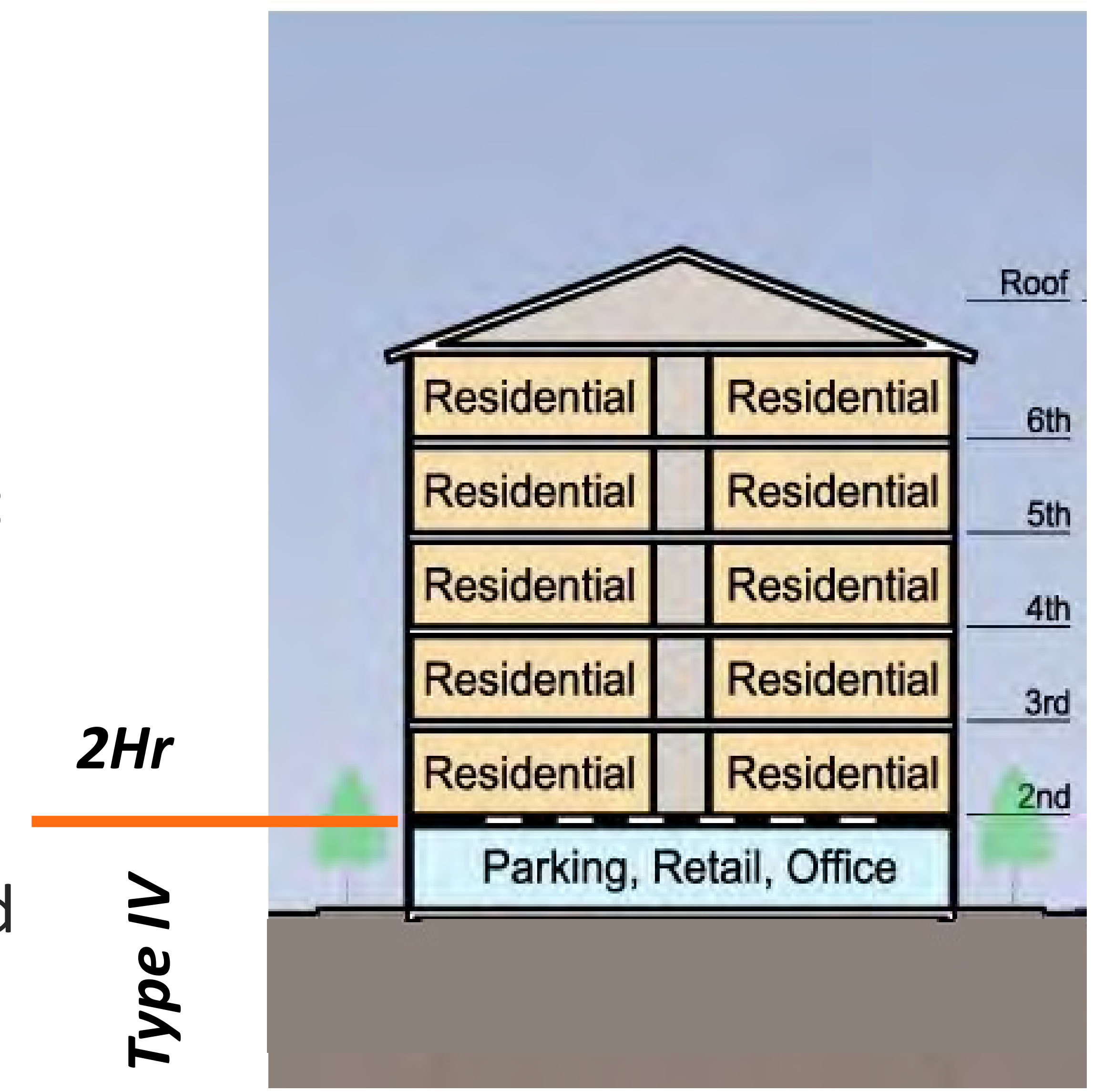
Starting in 2015, IBC allows multiple podium stories above grade.

Parking Beneath Group R – IBC 510.4

Possibility of a Type IV podium where number of stories starts above parking when:

- Occupancy above is R and below is S-2
- Lower floor is open Type IV parking with grade entrance
- Horizontal assembly between 1st and 2nd floor shall be:
    - Type IV
    - Have 1 hr fire resistance rating when sprinklered
    - Have 2 hr fire resistance rating when not sprinklered
- Overall height is still limited to occupancy

http://www.woodworks.org/experttip/can-parking-incorporated-mixed-use-wood-frame-buildings-construction-type-perspective/



5 story Type III Building On Top of a Type IV

Horizontal Separation

Horizontal Wood Assemblies are effectively used to transition from Residential units above to Retail/Parking below

SEAOC 2012 CONVENTION PROCEEDINGS

All-wood Podiums in Mid-rise Construction

Michelle Kam-Biron, S.E.
WoodWorks
Newbury Park, CA

Karyn Beebe, P.E., LEED AP
APA
San Diego, CA

Abstract

Concern for the environment and climate change as well as the economic downturn of the past few years have created a demand for sustainable multi-family housing. According to the Washington, D.C.-based National Association of Home Builders Multifamily Production Index (MPI), a leading indicator for the multi-family market, the apartment and condominium housing market has shown steady improvement for six consecutive quarters. However, today's economic and environmental realities have led the building industry to re-evaluate the way we design and build multi-story buildings.

Mid-rise podium construction, consisting of two to four stories of wood framing above a concrete first story (the "podium") and often incorporating additional subterranean concrete levels, is common throughout North America and in levels of residential units built on top of one or two levels of parking or other non-residential occupancies below. In this paper, we are defining wood podium as the level (or transfer level) between the two or more stories of wood-framed residential occupancy and the lower non-residential occupancy which is traditionally constructed of concrete. In an article titled, "What to Build Now," by Michael Russo, Dan Withee, AIA, LEED AP, and partner with Withee Malcolm Architects LLP in Torrance, CA states, "Wood podium is basically tuck-under apartments on steroids."

The projects described in this paper have parking, retail, and restaurant space on their first level. The podium is composed of gypcrete (or light weight concrete) topping over wood structural panels supported by I-joists and glued laminated (glulam) beams. Both design teams made a conscientious effort to not utilize concrete or steel framing.

ALL-WOOD PODIUMS

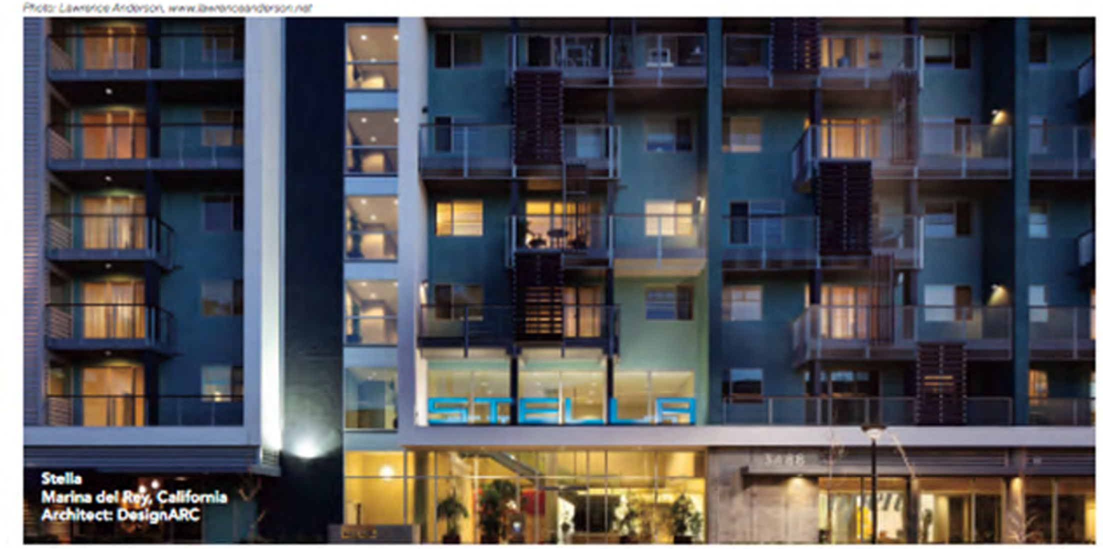
Although a podium structure typically refers to wood-frame construction over concrete, a handful of designers have lowered their costs even further by designing the podium in wood.

"When determining the cost of a structure, there are a lot variables, including most notably time, materials and labor," said Karyn Beebe, P.E., of APA. "Using wood instead of concrete lowers the mass of the building, which results in more economical podium shear walls and foundations. Using the same material for the entire structure may also mean lower design costs, and the construction team experiences savings in the form of fewer trades on site, which means less mobilization time, greater efficiency because framing is repeated on all of the levels, easier field modifications, and a faster schedule."

Architect Dan Withee, AIA, LEED AP, of Withee Malcolm Architects designed an 85-unit wood podium project in San Diego. He estimated that a concrete podium can cost $15,000 per parking space compared to $9,500 for wood podium.[6]

CONTINUING EDUCATION

Photo: Lawrence Anderson, www.lawrenceanderson.net



Stella
Marina del Rey, California
Architect: DesignARC

Multi-Story Wood Construction

A cost-effective and sustainable solution for today's changing housing market

Sponsored by reThink Wood and WoodWorks

Cost-effective, code-compliant and sustainable, mid-rise wood construction is gaining the attention of design professionals nationwide, who see it as a way to achieve higher density housing at lower cost—while reducing the carbon footprint of their projects. Yet, many familiar with wood construction for two- to four-story residential structures are not aware that the International Building Code (IBC) allows wood-frame construction for five stories and more in building occupancies that range from business and mercantile to multi-family, military, senior, student and affordable housing.

"Once designers know that wood offers all ... but its benefits are equally applicable to other occupancy types."

Among their benefits, wood buildings typically offer faster construction and reduced installation costs. For example, after completing the first phase of a developer-funded five-story student housing project using steel construction, OKW Architects in Chicago switched to wood. "The 12-gauge steel panels were expensive, very heavy and difficult to install; and welding and screwing the shear strap bracing was very time consuming," says project architect Eileen Schoeb. "Using wood was far more economical for the second phase." Farooq Maniar, president of California-based Farooq Maniar, Inc. and

CONTINUING EDUCATION

EARN ONE AIA/CES HSW LEARNING UNIT (LU)

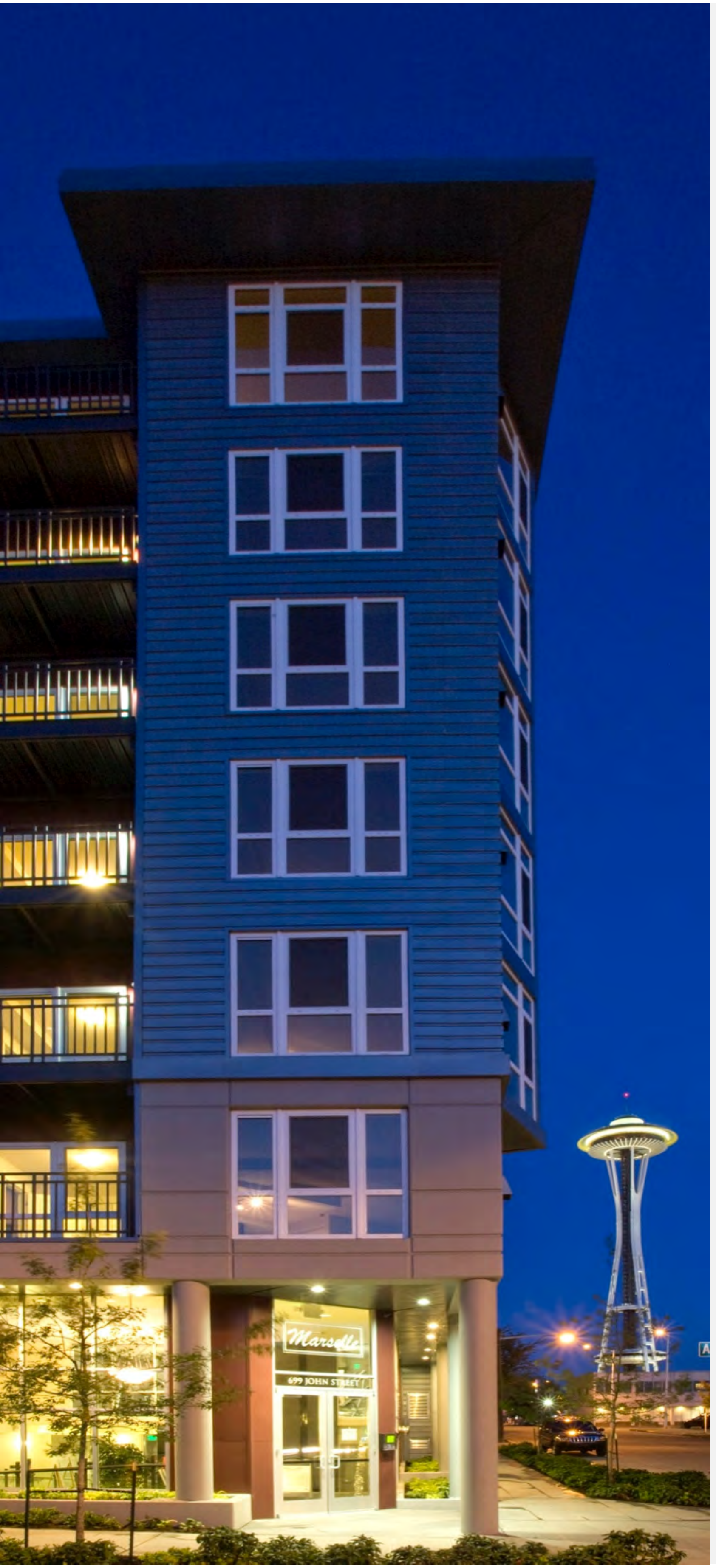
EARN ONE GBCI CE HOUR FOR LEED CREDENTIAL MAINTENANCE

Learning Objectives
After reading this article, you should be able to:
1. Identify the sustainability and economic benefits of using wood construction for mid-rise buildings.
2. Summarize building code requirements and provisions for mid-rise multi-family

2018 Code Conforming Wood

Table of Contents

Available for Free Download: www.awc.org



5 Minute Break!

Jason Bahr, PE
Regional Director – KS, MO, OK and AR
Jason.bahr@woodworks.org
913-732-0075

Copyright Materials

Disclaimer: The information in this presentation, including, without limitation, references to information contained in other publications or made available by other sources (collectively "information") should not be used or relied upon for any application without competent professional examination and verification of its accuracy, suitability, code compliance and applicability by a licensed engineer, architect or other professional. Neither the Wood Products Council nor its employees, consultants, nor any other individuals or entities who contributed to the information make any warranty, representative or guarantee, expressed or implied, that the information is suitable for any general or particular use, that it is compliant with applicable law, codes or ordinances, or that it is free from infringement of any patent(s), nor do they assume any legal liability or responsibility for the use, application of and/or reference to the information. Anyone making use of the information in any manner assumes all liability arising from such use.