Maximizing Mid-Rise Value with Wood: Design Tips for Podiums, Sloped Sites and Other Complexities

Presented by Jay Ierardi, PhD, PE

AKF

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.

"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

While more developers and design teams are choosing wood for four- to six-story buildings because of its cost efficiency, design complexities such as podiums, sloping sites, lot line proximities and basements add to the challenge of navigating code provisions. This presentation will explore those provisions with an emphasis on allowances that increase density while ensuring fire and life safety performance. Topics will include podiums and vertical offsets, sloping sites and how to determine number of stories, allowances for single and multi-level basements, high-rise provisions and when they’re applicable, fire walls, mezzanines, and more.

Learning Objectives

1. Discuss building code requirements applicable to podiums, including allowable building height, vertical offsets and fire-resistance requirements.

2. Highlight fire and life safety and building size code provisions applicable to Type III and V mid-rise wood construction.

3. Investigate methods of maximizing lot utilization such as multi-story basements and mezzanines, discussing code compliance for each.

4. Explore design and detailing strategies for fire-rated walls in typical mid-rise construction such as fire walls and exterior walls adjacent to lot lines.

IBC Chapter 5 – General Building Heights & Areas

IBC Section 504 – Building Height and Number of Stories

TABLE 504.3*
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
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S									
H-4	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 1, I-3	NS[c, e]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 2, I-2	NS[c, d, e]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85						
I-4	NS[c, b]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
R	NS[c, b]	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

TABLE 504.4[a, b]—continued
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
R-1	NS[d, h]	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[d, h]	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
R-3	NS[d, h]	UL	11	4	4	4	4	4	3	3
	S13R	4	4						4	4
	S	UL	12	5	5	5	5	5	4	4
R-4	NS[d, h]	UL	11	4	4	4	4	4	3	2
	S13R	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
S-2	NS	UL	11	5	3	4	3	4	4	2
	S	UL	12	6	4	5	4	5	5	3
U	NS	UL	5	4	2	3	2	4	2	1
	S	UL	6	5	3	4	3	5	3	2

Horizontal Building Separation Allowance (IBC Section 510.2)

Buildings Permitted to be Considered Separate in:

- Determining Area Limitations
- Continuity of Fire Walls
- Limitation of Number of Stories
- Type of Construction

When the Following are Provided:

- 3-Hour Horizontal Assembly Separating the Buildings
- Building Below the Assembly is Type IA Construction with Sprinkler Protection
- Shafts are Protected in Accordance with IBC Section 713.4
- Building(s) Above are Group A (<300 People), B, M, R, or S
- Maximum Building Height does not Exceed Limits in IBC Section 504.3

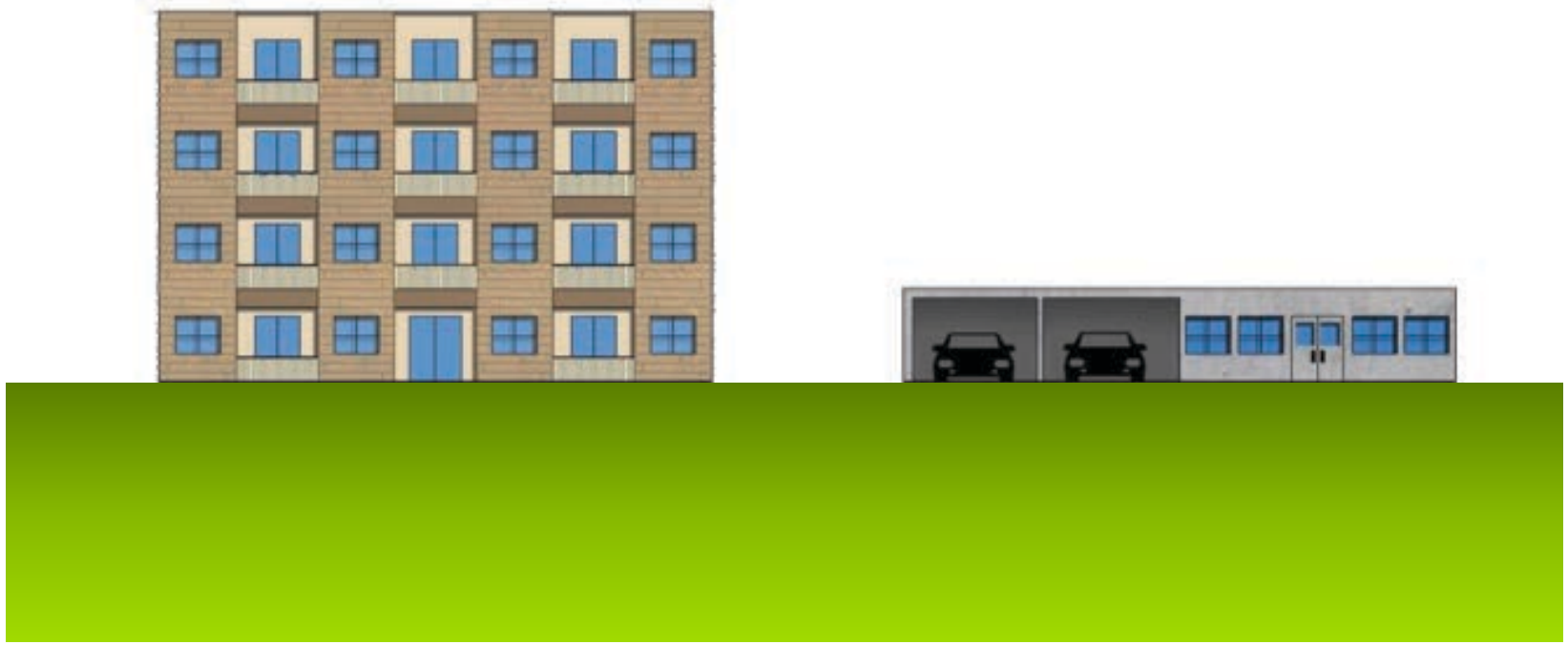

Residential - 4 Stories
Commercial 1st Floor


Residential - 4 Stories
4
3
2
1
Commercial - 1 Story

The Podium Concept

The Urban Design Challenge

- R-2 Fully Sprinklered Type VA Building
- Parking Provided in an Adjacent Type IA Parking Structure



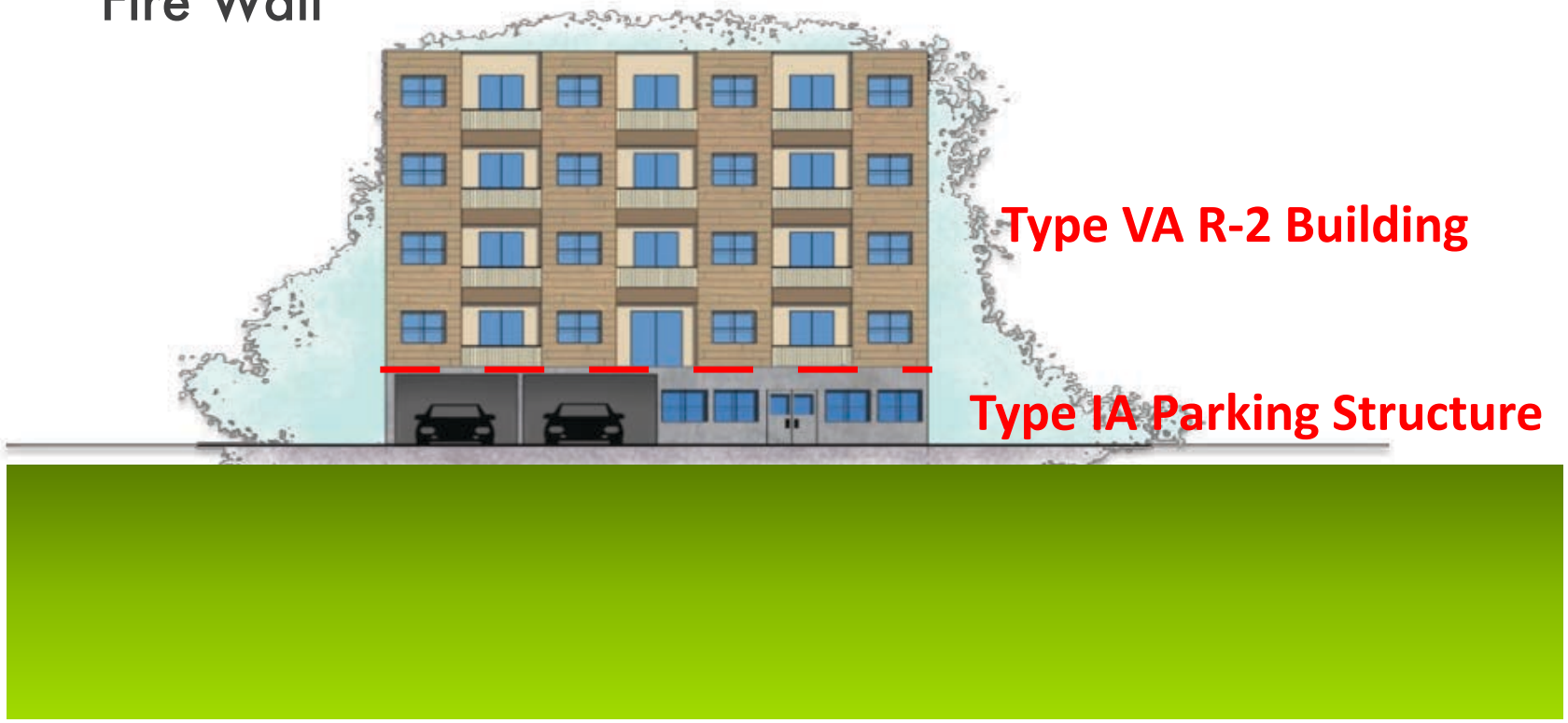
Type VA R-2 Building

Type IA Parking Structure

The Podium Concept

The Urban Design Solution

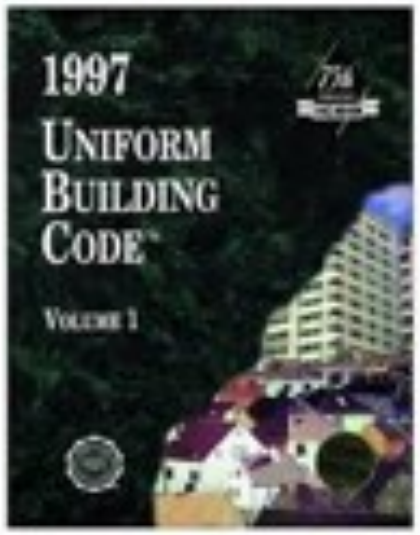
- 'Stack' the R-2 Fully Sprinklered Type VA Building on top of the Type IA Parking Structure
- Mixed Construction Types Separated by a Horizontal Fire Wall

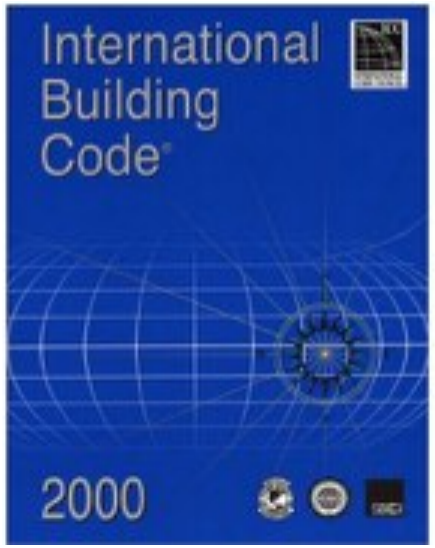


The History of the Podium Approach

Originally a 1970's UBC Provision

- Mixed Construction Types for Basement and/or 1 Story Enclosed Parking below 3-Hour Horizontal Separation with Type A, B, M, or R above
- 1990's UBC Allowed A<300 (1 Room), B, and M below 3-Hour Horizontal Separation if the Podium is Sprinklered
- 2000 IBC Incorporates UBC Provisions

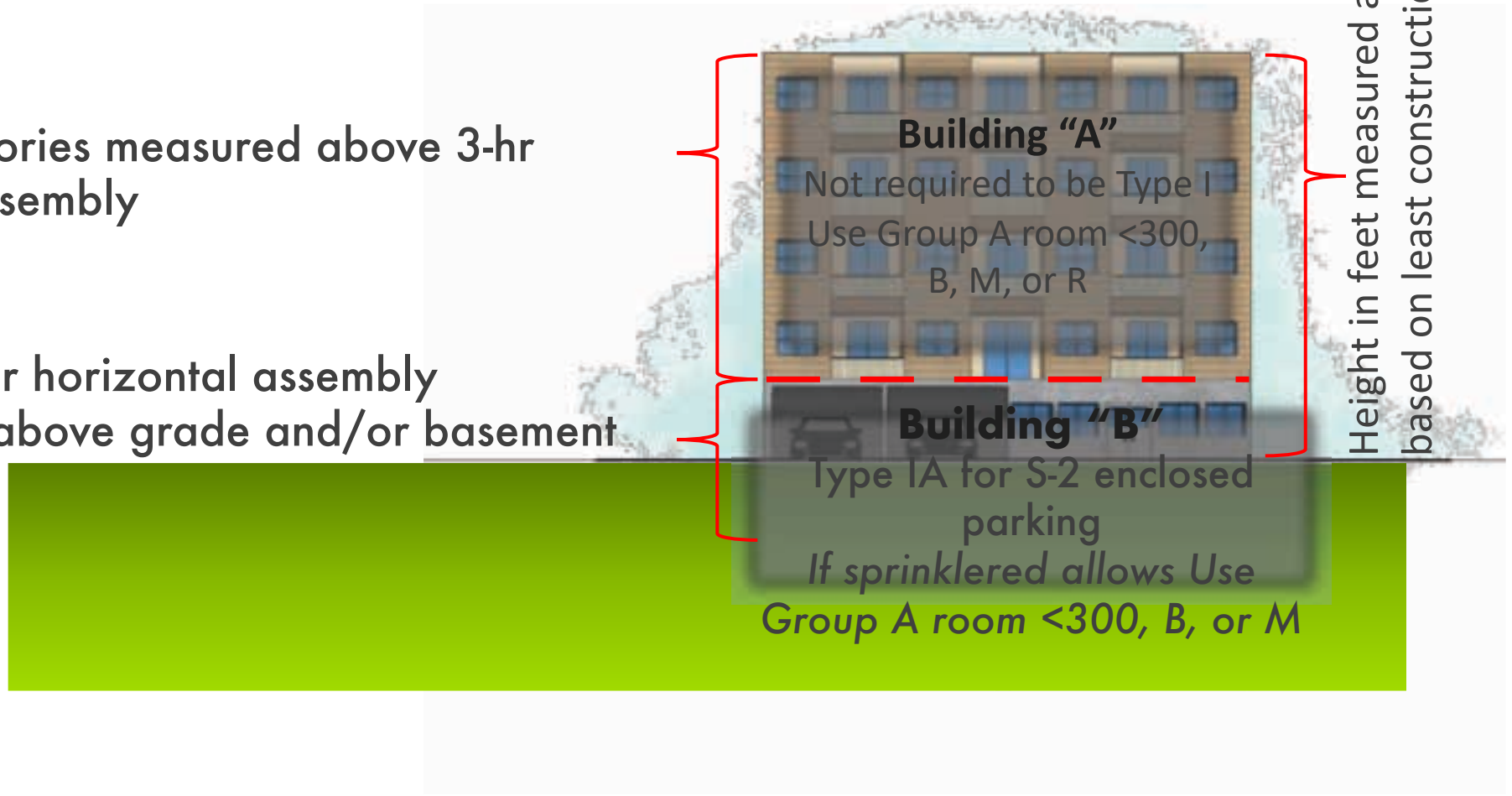




2000 IBC Section 508.2

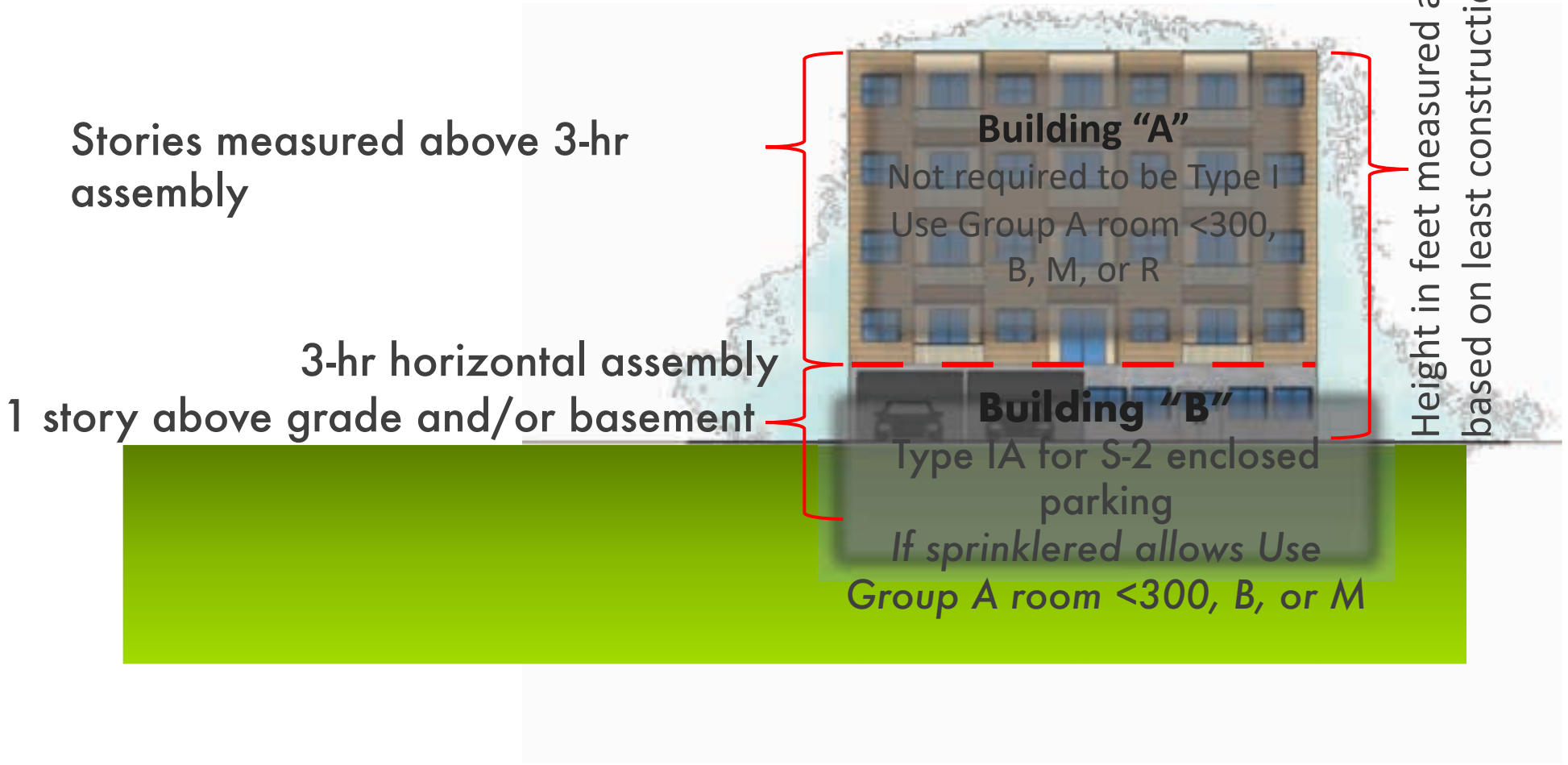
Stories measured above 3-hr assembly

3-hr horizontal assembly
1 story above grade and/or basement



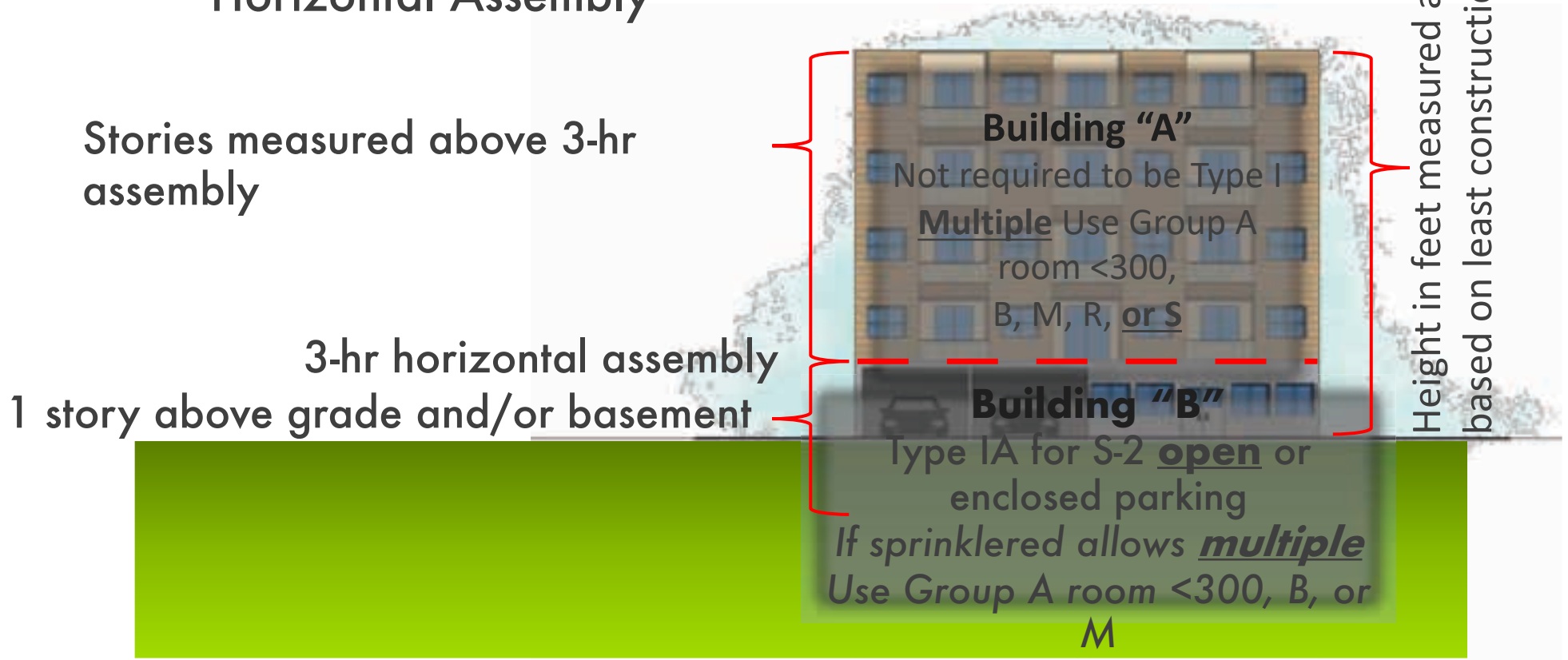
2003 IBC Section 508.2

- Minor Reformatting – No Technical Changes



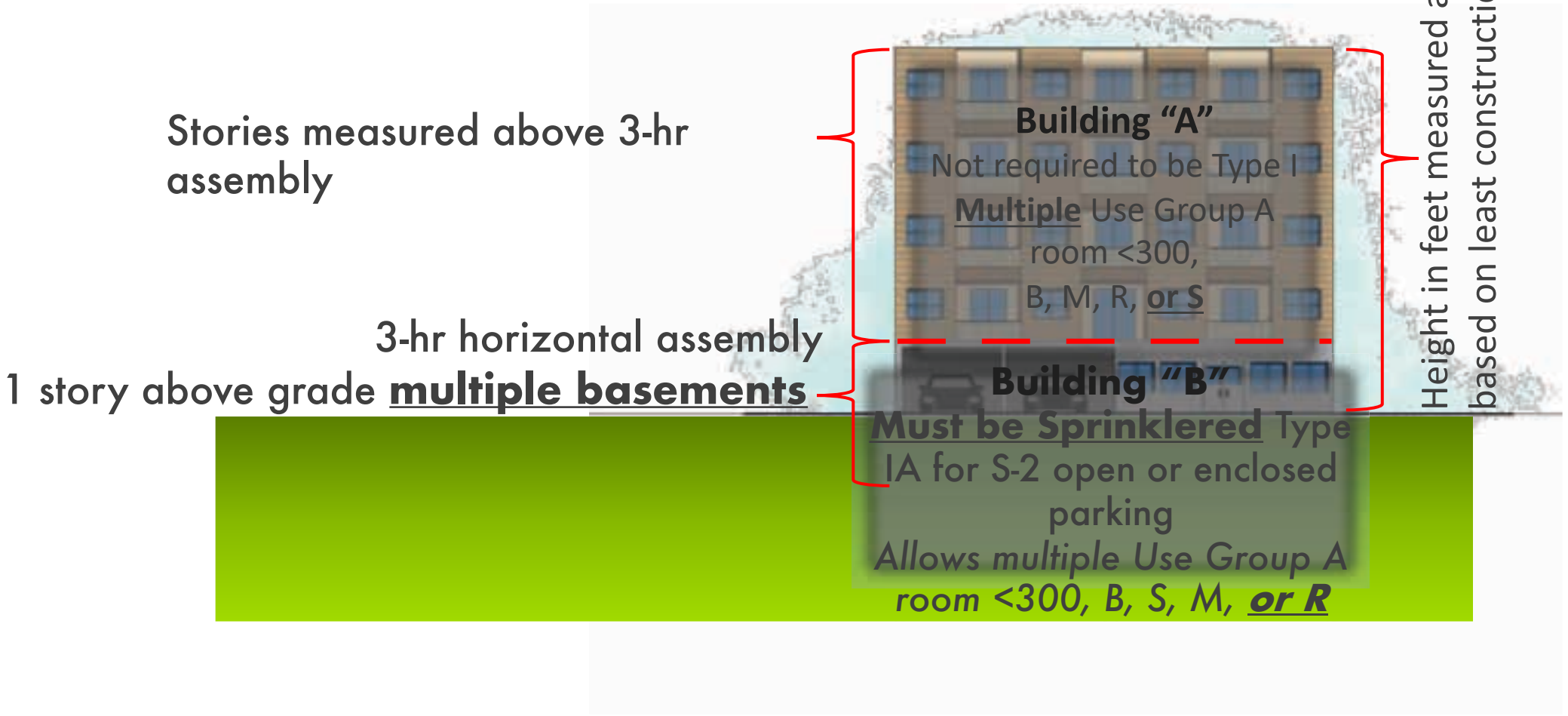
2006 IBC Section 509.2

- Moved from Section 508.2 to 509.2
- Additional Use Groups Permitted above and below the Horizontal Assembly



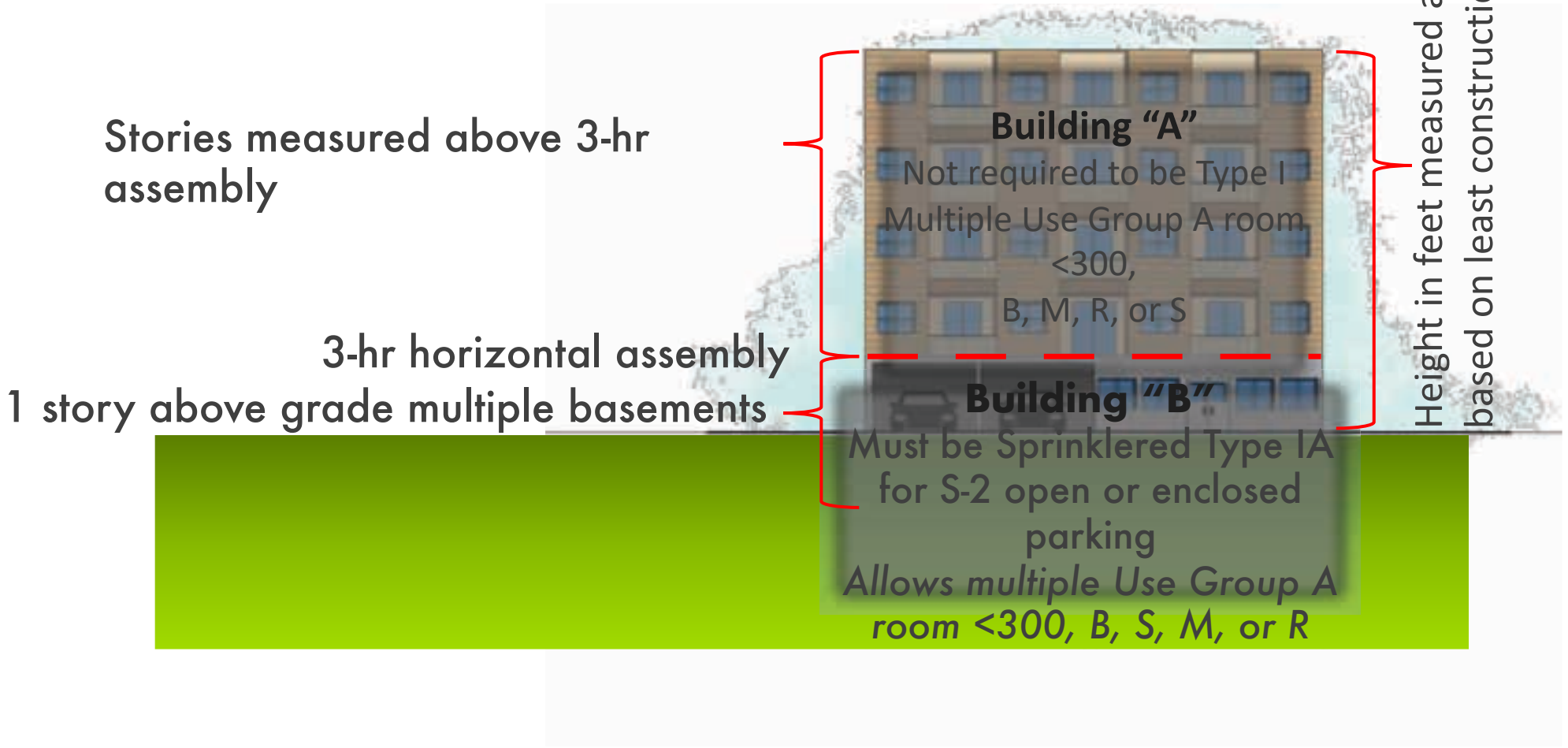
2009 IBC Section 509.2

- Sprinklers are Mandatory below the 3-Hour Assembly
- More Use Group Options below Assembly



2012 IBC Section 510.2

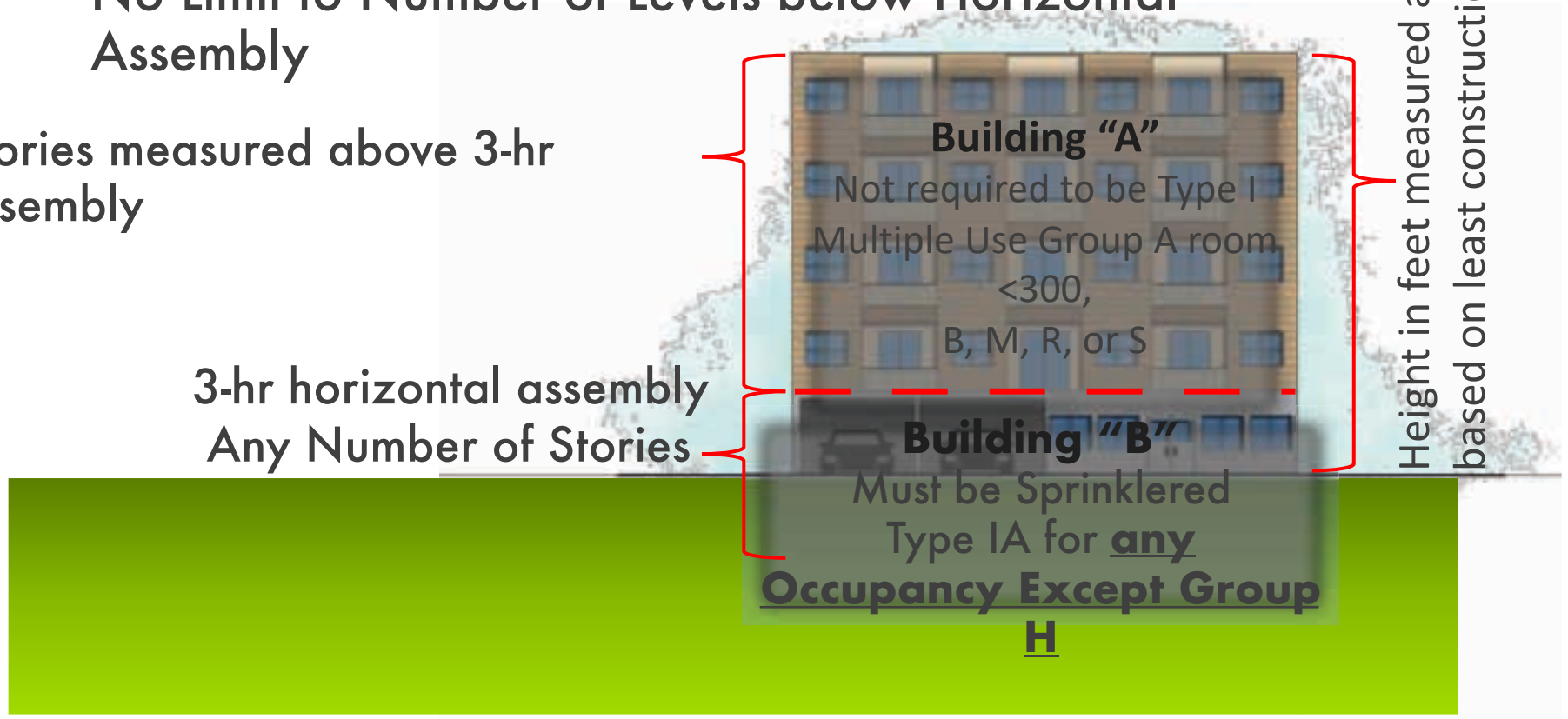
- Moves from Section 509.2 to 510.2 – No Technical Changes



2015 IBC Section 510.2

- Any Occupancy (Except Group H) Permitted below Assembly
- No Limit to Number of Levels below Horizontal Assembly

Stories measured above 3-hr assembly



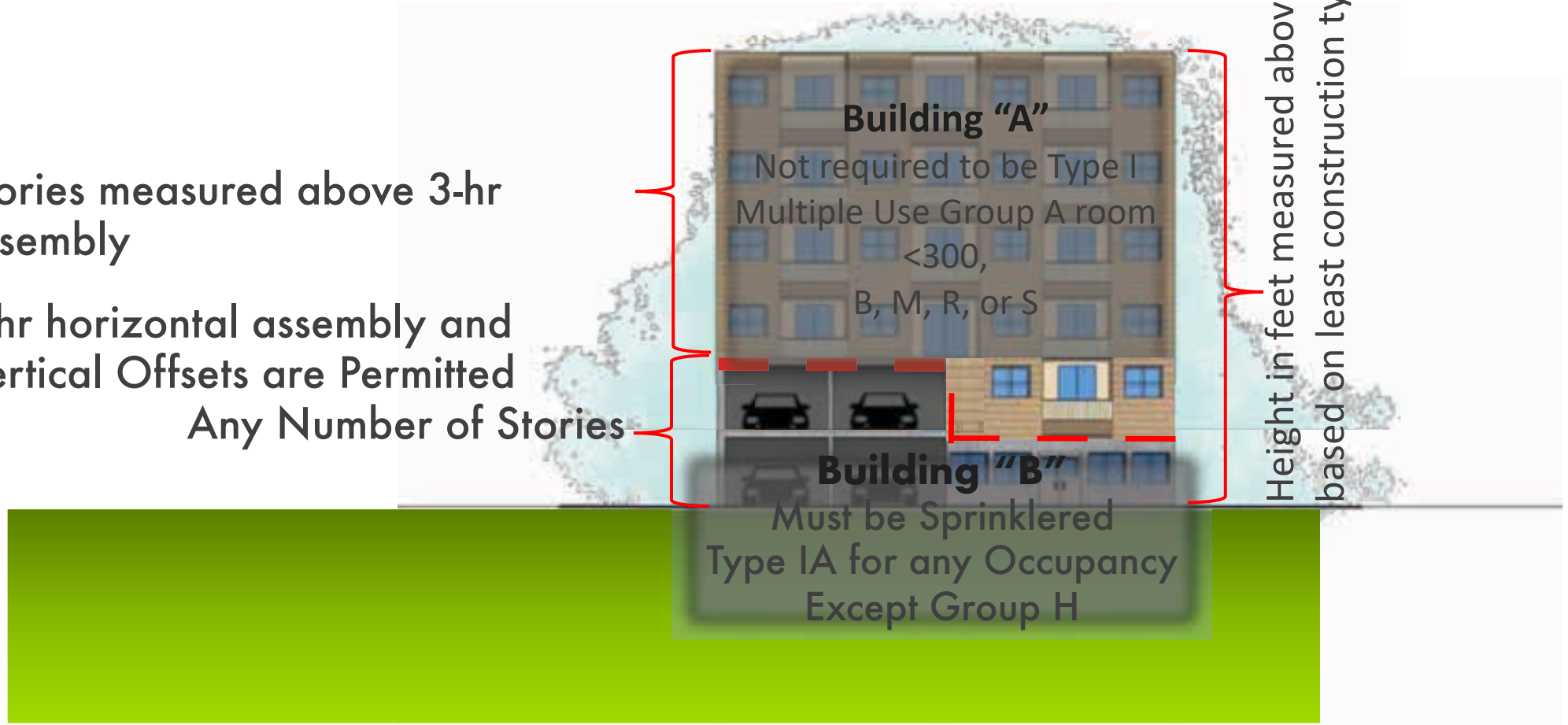
2018 IBC Section 510.2

- Vertical Offsets are Permitted

Stories measured above 3-hr assembly

3-hr horizontal assembly and Vertical Offsets are Permitted

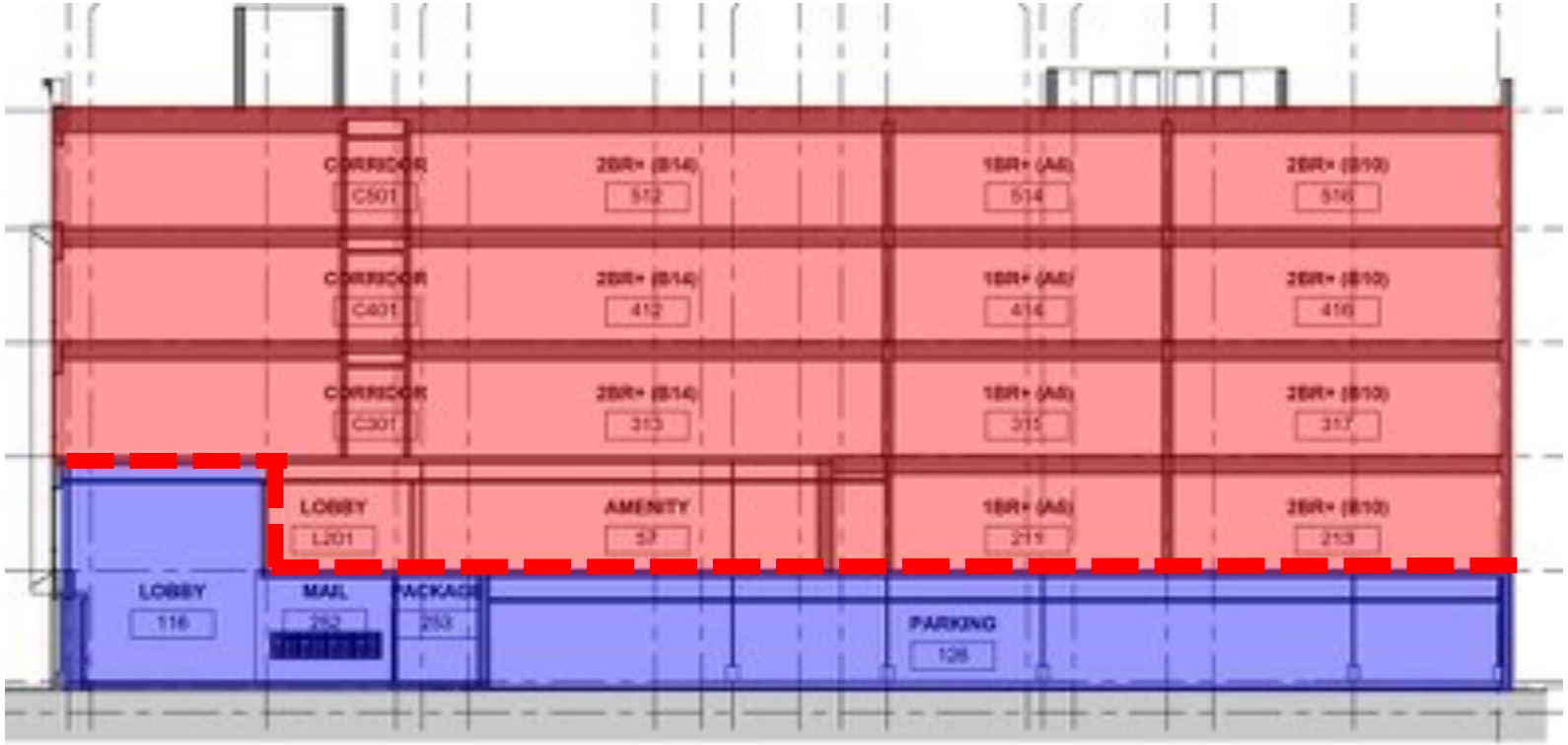
Any Number of Stories



Vertical Offsets in Podium Construction

Vertical Offsets in Podiums Allow for:

- Double Height Lobby Spaces



Vertical Offsets in Podium Construction

Vertical Offsets in Podiums Allow for:

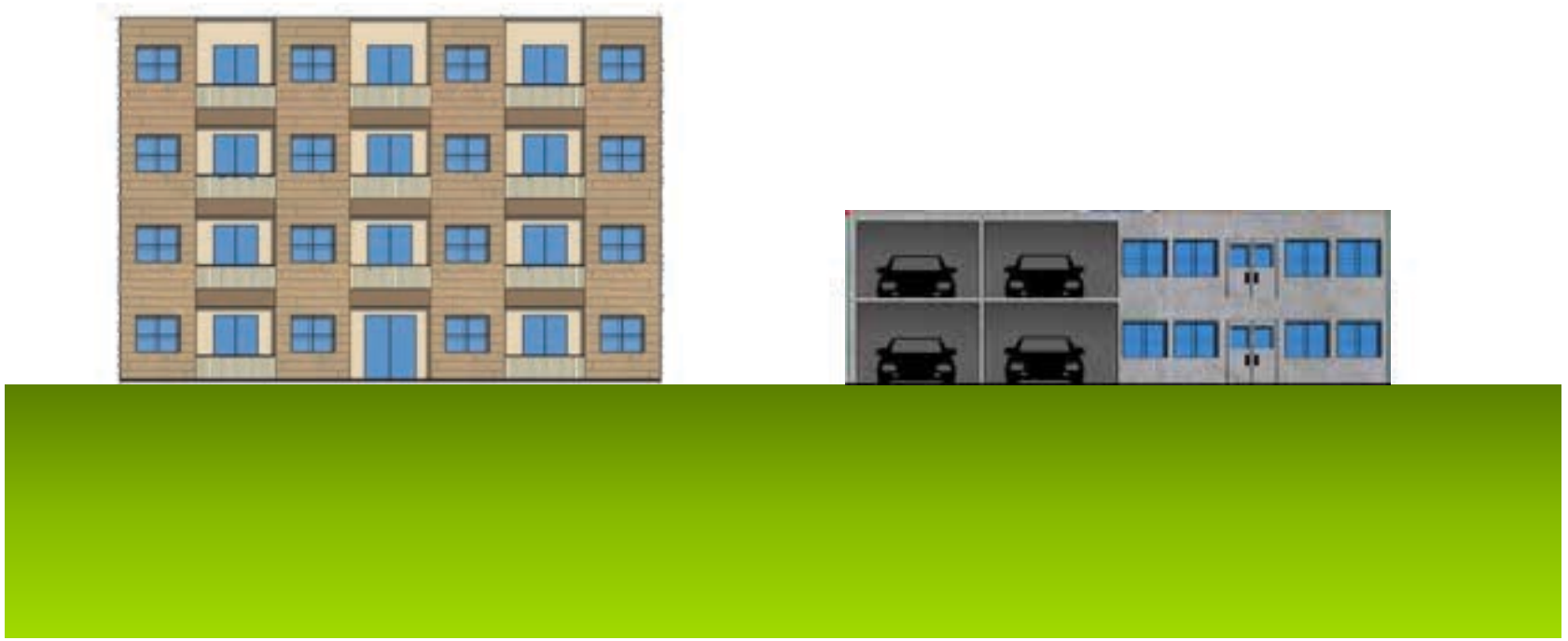
- Relief in the Continuity of Fire Walls

Use Group R-2 in Type VA - Fully Sprinklered

Allowable Height: 4 stories, 70 ft

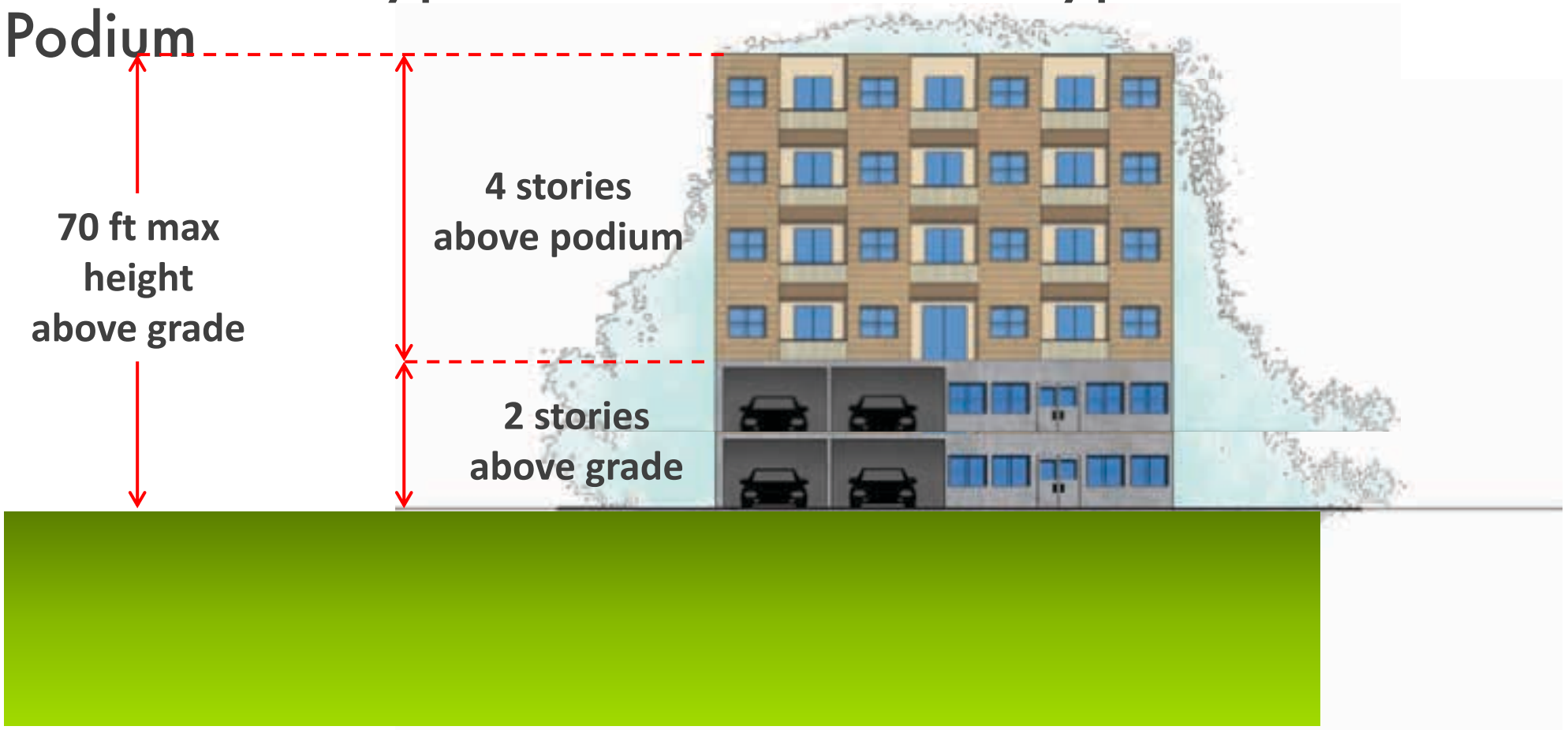
Allowable Footprint Area: 36,000 sf, up to 45,000 sf with 100% frontage

Allowable Aggregate Area: 108,000 gsf, up to 135,000 gsf with 100% frontage



Use Group R-2 in Type VA - Fully Sprinklered

4 Stories R-2 Type VA Construction on Type IA Podium

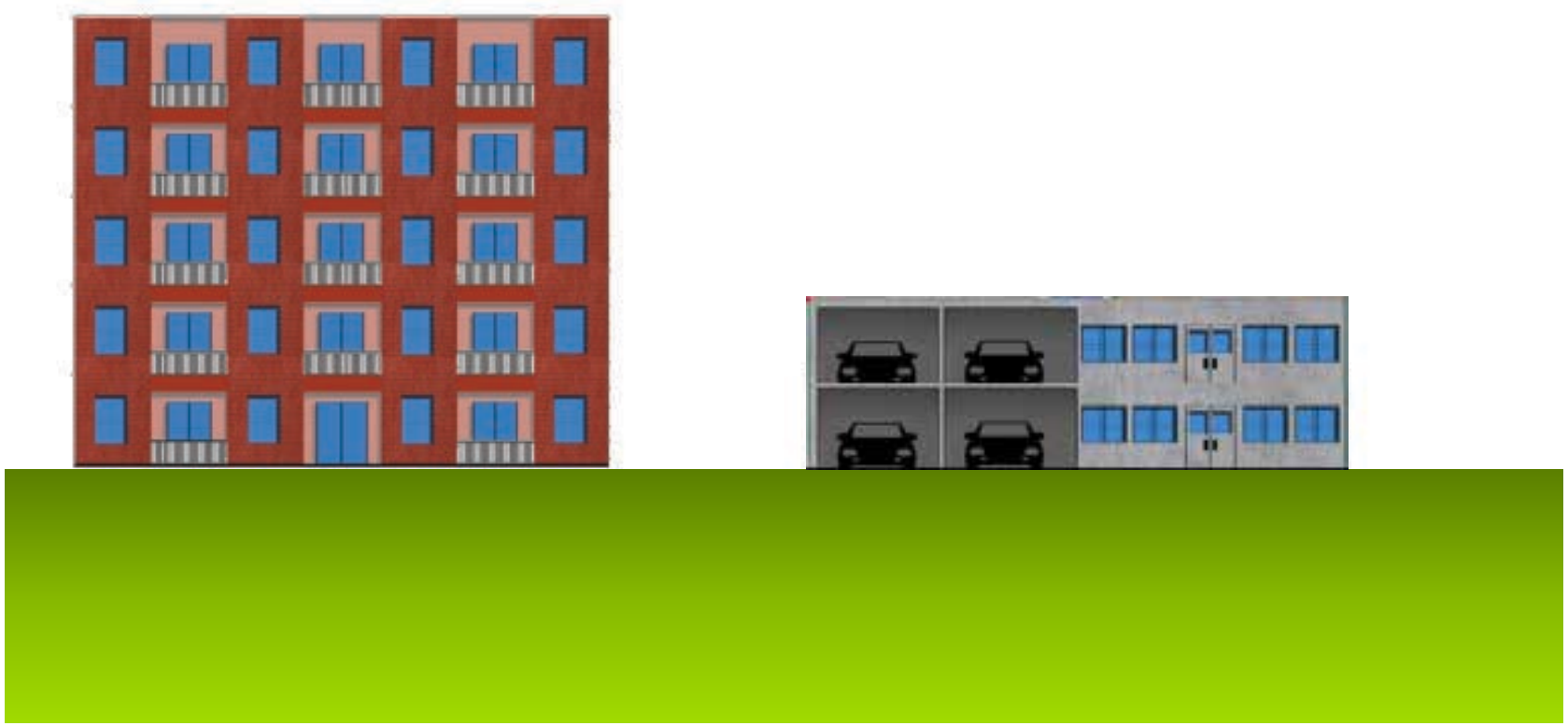


Use Group R-2 in Type IIIA - Fully Sprinklered

Allowable Height: 5 stories, 85 ft

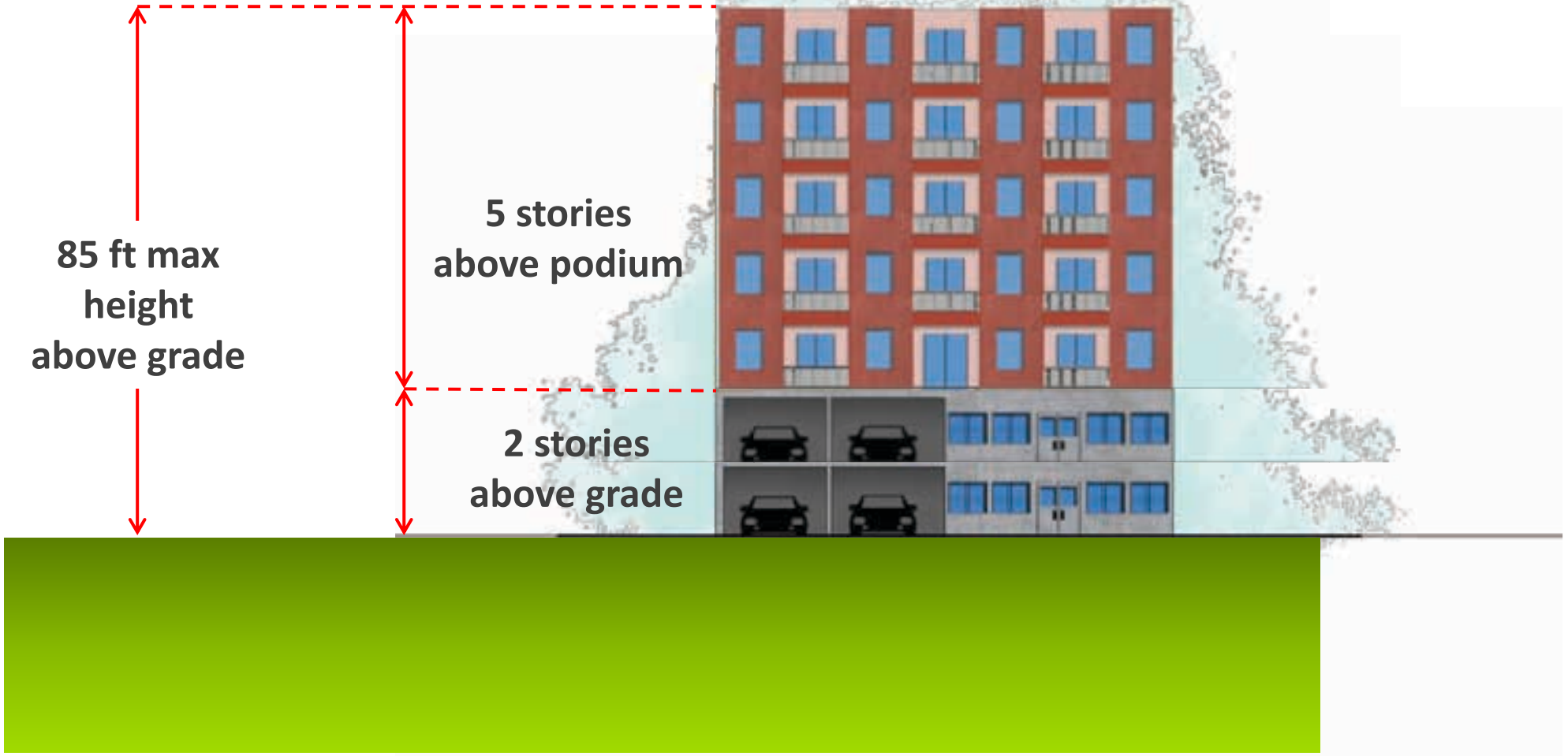
Allowable Footprint Area: 72,000 sf, up to 90,000 sf with 100% frontage

Allowable Aggregate Area: 216,000 gsf, up to 270,000 gsf with 100% frontage



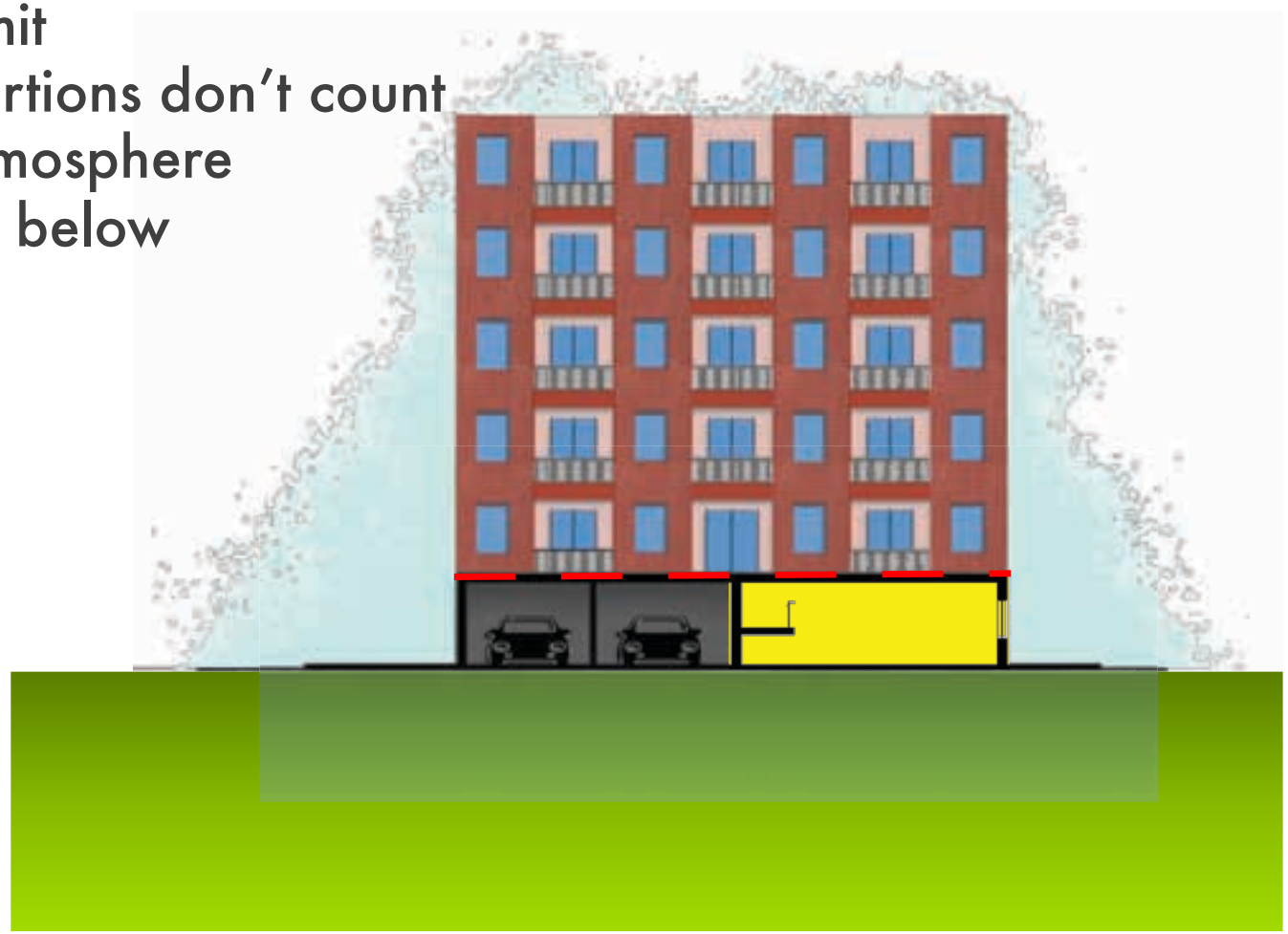
Use Group R-2 in Type IIIA - Fully Sprinklered

5 Stories R-2 Type IIIA Construction on Type IA Podium



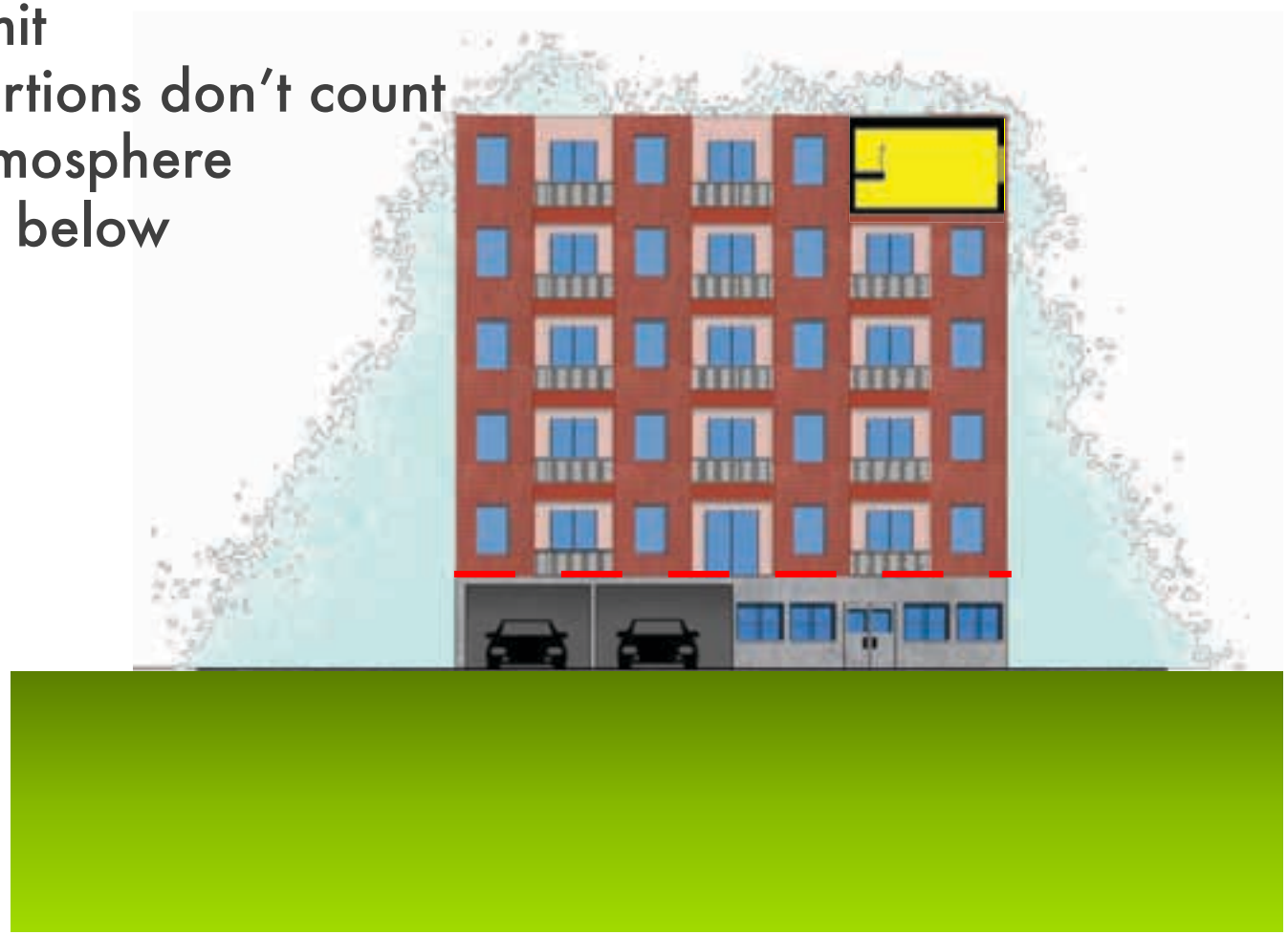
Mezzanines Below the Separation

- Section 505 Mezzanines
- 1/3 area limit
- Enclosed portions don't count
- Common atmosphere
- Part of floor below
- Not a story



Mezzanines Above the Separation

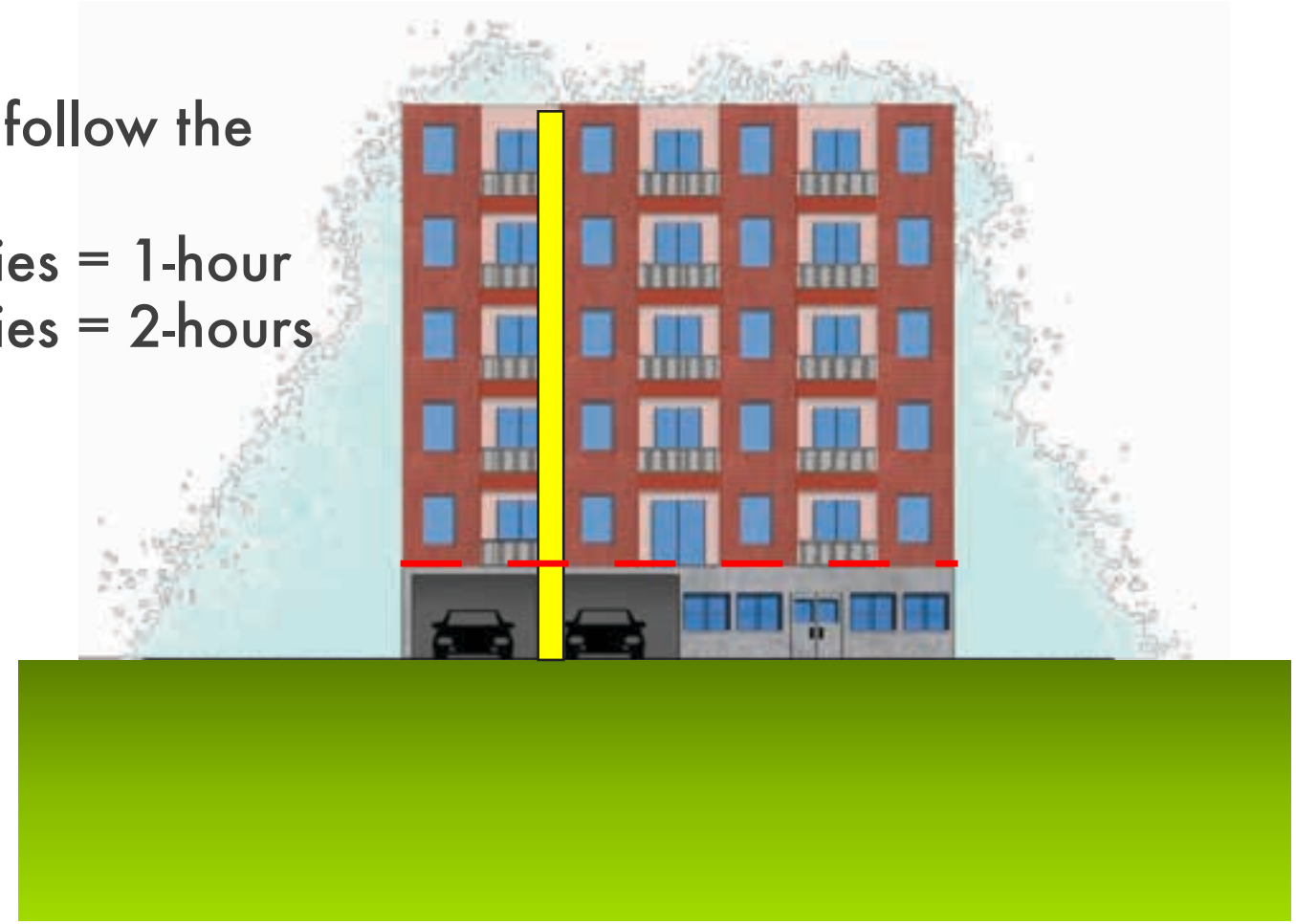
- Section 505 Mezzanines
- 1/3 area limit
- Enclosed portions don't count
- Common atmosphere
- Part of floor below
- Not a story



Shafts Penetrating the 3-Hour Assembly

Shafts are permitted to follow the requirements of 713.4

- Connecting <4 Stories = 1-hour
- Connecting 4+ Stories = 2-hours

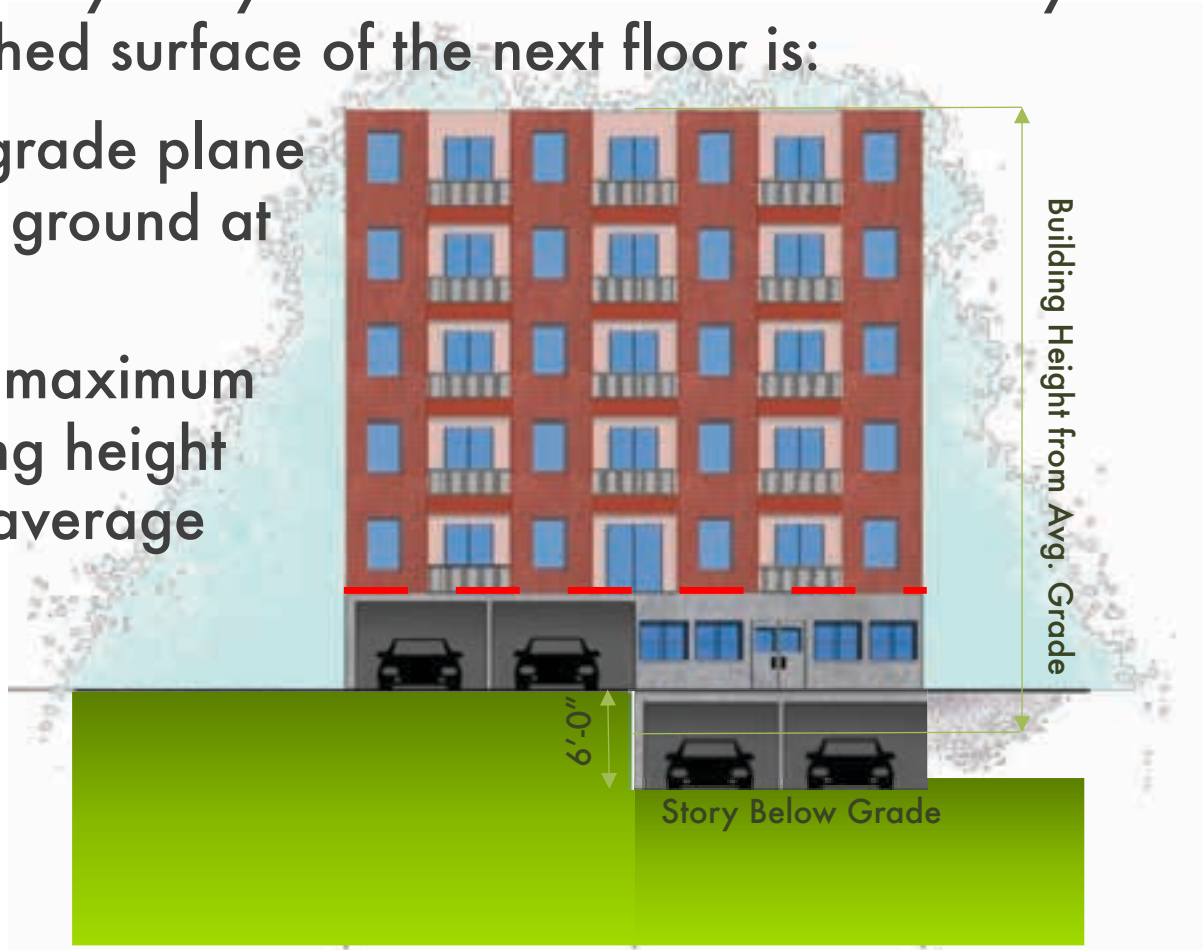


Story Above Grade

Stories above grade are any story with the finished floor entirely above grade or the finished surface of the next floor is:

- More than 6′ above grade plane
- More than 12′ above ground at any point

This is separate from the maximum allowable podium-building height which is measured from average grade

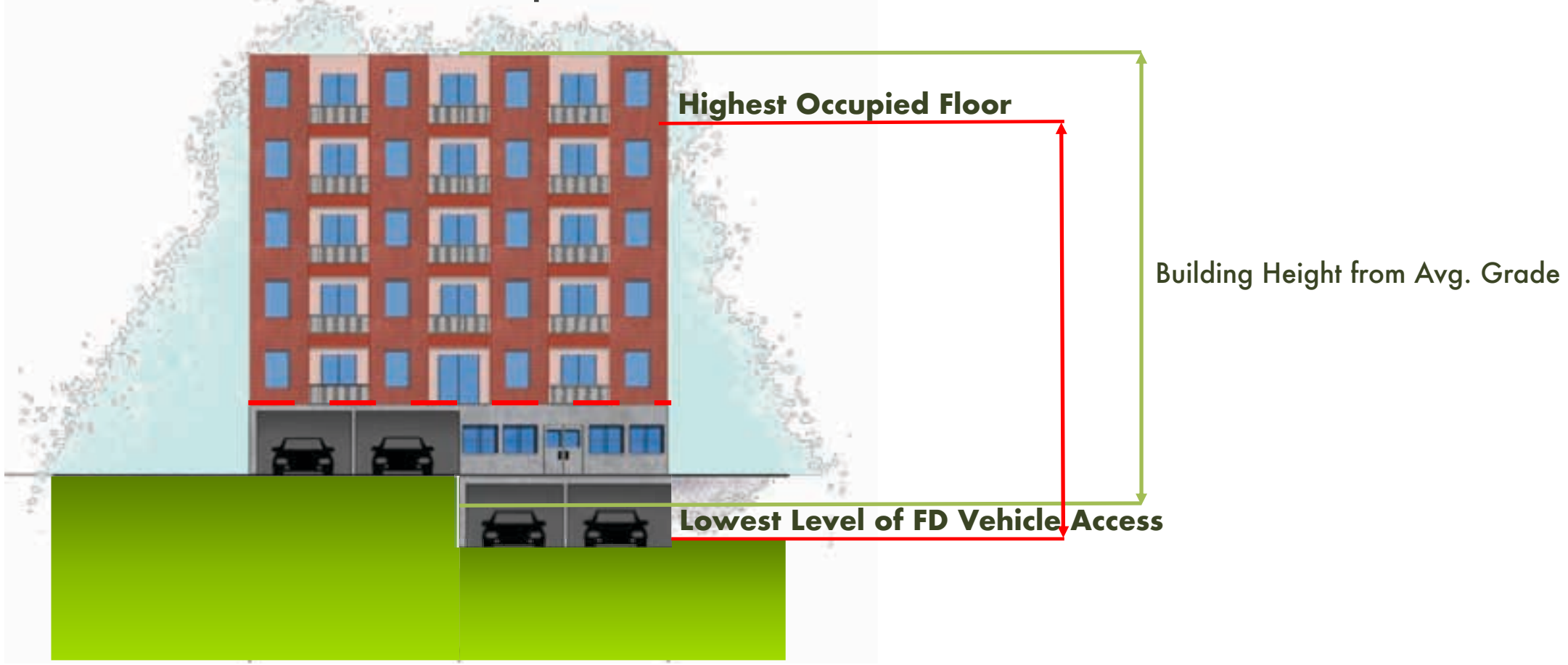


Basements

- Podium is Type IA unlimited height and area
- Multiple basement levels permitted

High-Rise Building Definition

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



High-Rise Building Features

IBC Section 403

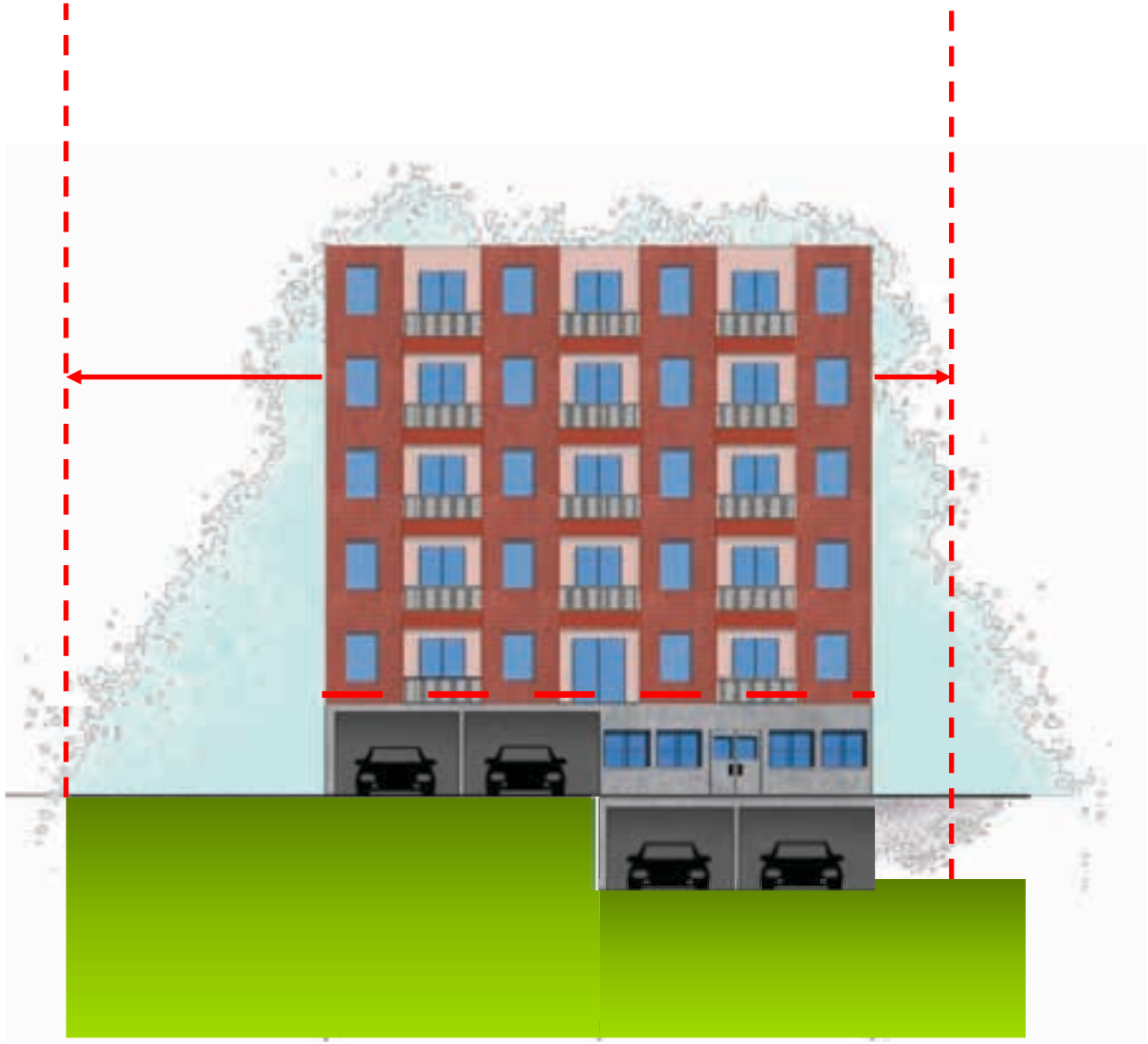
- Secondary on-site water supply if located in Seismic Design Category C, D, E, or F
- Emergency voice/alarm communication system
- Emergency responder radio coverage
- Fire command center
- Post-fire smoke removal
- Standby and emergency power
- Luminous egress path markings in Group A, B, E, I, M, and R-1 occupancies

Fire Separation Distance Definition

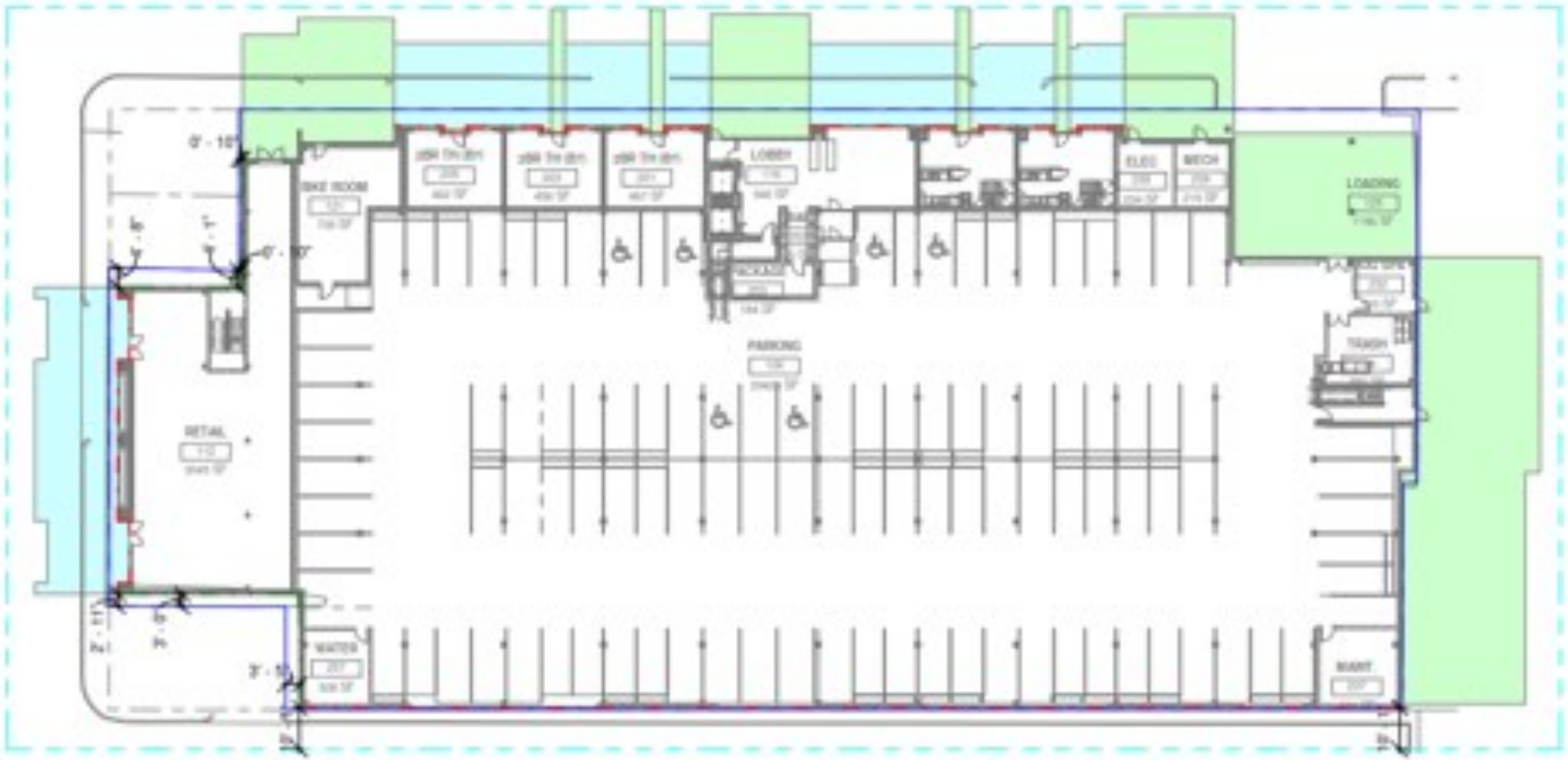
The distance measured from the building face to one of the following:

1. The closest interior lot line.
2. To the centerline of a street, an alley, or public way
3. To an imaginary lot line between two buildings on the same lot.

The distance is measured at right angles from the face of the wall



Fire Separation Distance in Plan View

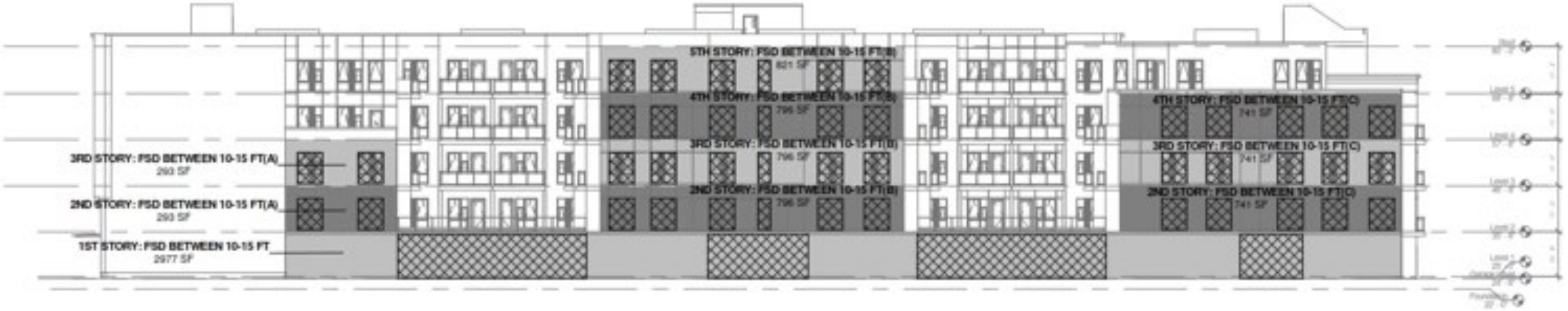


Exterior Wall Openings

Allowable percentage of exterior openings are governed by Table 705.8 and for fully sprinklered buildings are as follows;

Fire Separation Distance (ft)	Allowable % of Ext. Openings
0 < 3 ft	0%
3 < 5 ft	15%
5 < 10 ft	25%
10 < 15 ft	45%
15 < 20 ft	75%
20+ ft	100%

PERCENT OPENINGS - ATHENS STREET				
REGION	TOTAL WALL AREA	OPENING AREA	PERCENT OPENINGS	ALLOWED OPENINGS
1ST STORY: FSD BETWEEN 10-15 FT	2977 SF	1362 SF	46%	45%
2ND STORY: FSD BETWEEN 10-15 FT(A)	293 SF	90 SF	31%	45%
2ND STORY: FSD BETWEEN 10-15 FT(B)	796 SF	248 SF	31%	45%
2ND STORY: FSD BETWEEN 10-15 FT(C)	741 SF	225 SF	30%	45%
3RD STORY: FSD BETWEEN 10-15 FT(A)	293 SF	90 SF	31%	45%
3RD STORY: FSD BETWEEN 10-15 FT(B)	796 SF	248 SF	31%	45%
3RD STORY: FSD BETWEEN 10-15 FT(C)	741 SF	225 SF	30%	45%
4TH STORY: FSD BETWEEN 10-15 FT(B)	796 SF	248 SF	31%	45%
4TH STORY: FSD BETWEEN 10-15 FT(C)	741 SF	225 SF	30%	45%
5TH STORY: FSD BETWEEN 10-15 FT(B)	821 SF	248 SF	30%	45%



Exterior Wall Ratings – Construction Type

Loadbearing exterior walls governed by Table 601 for construction type;

Construction Type	Loadbearing Ext Wall Rating (hrs)
VB	0
VA	1
IIIB	2
IIIA	2
IV-HT	2

Exterior Wall Ratings – Fire Separation Distance

Nonbearing and bearing exterior walls governed by Table 602 for FSD;

FSD (ft)	Construction Type	Use Group F-1, M, S-1	Use Group A, B, E, F-2, I, R, S-2, U
< 5	VB, VA, IIIB, IIIA, IV-HT	2	1
5 < 10	VB, VA, IIIB, IIIA, IV-HT	1	1
10 < 30	VB	0	0
	VA, IIIB, IIIA, IV-HT	1	1
30 +	VB, VA, IIIB, IIIA, IV-HT	0	0

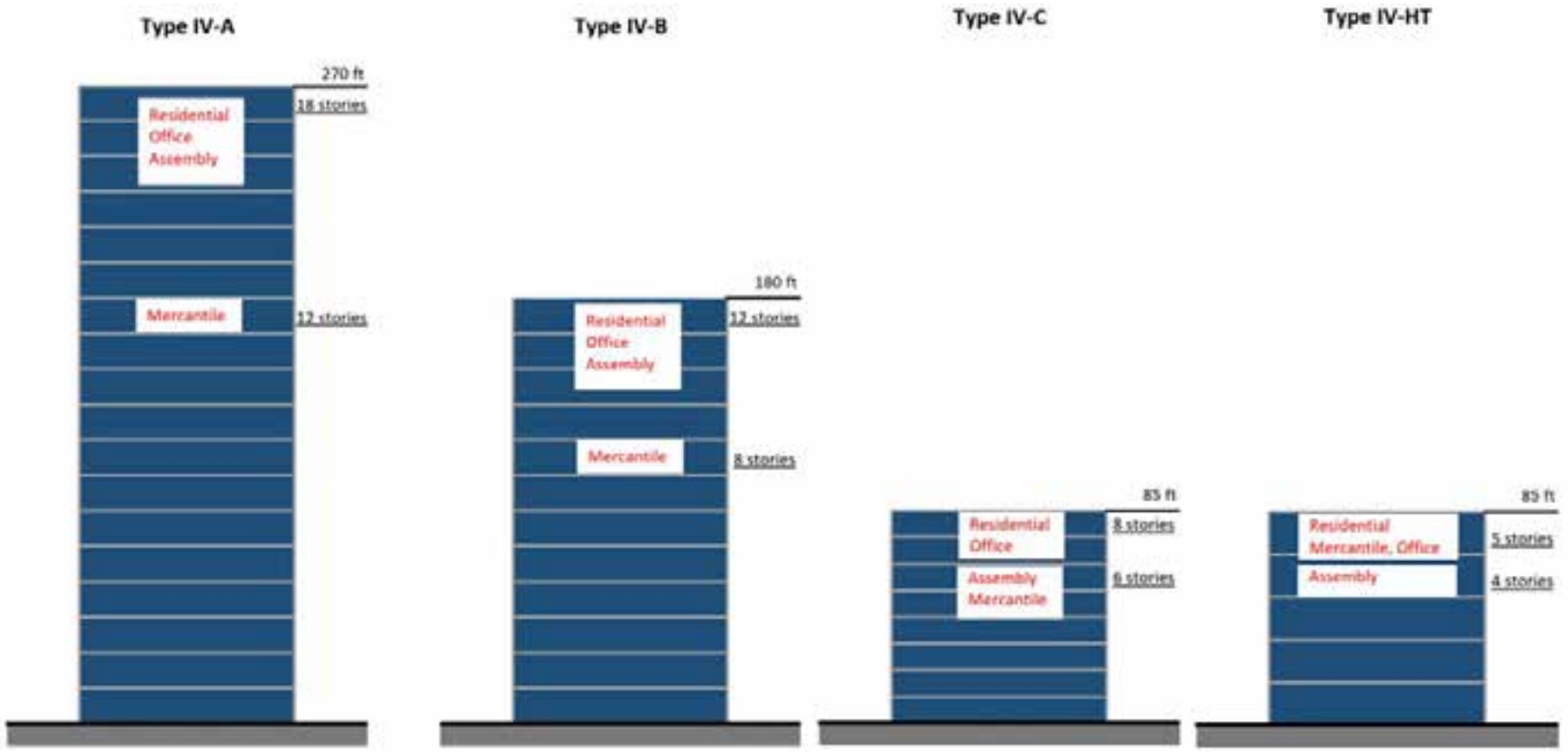
Notes:

- Where Table 705.8 permits nonbearing exterior walls to have unlimited openings, the exterior wall rating can be 0 hours.
- Where FSD is less than or equal to 10 ft, exterior wall must be rated for exposure to fire on both sides

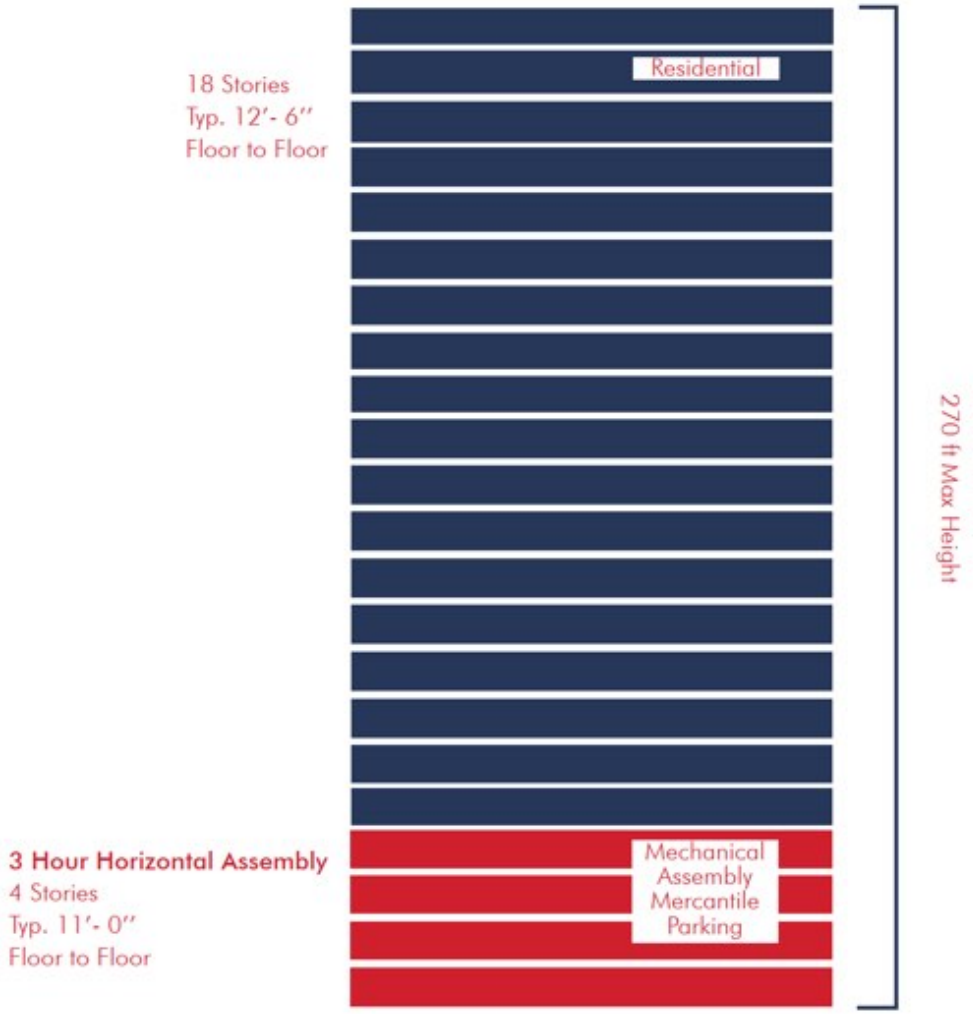
2021 IBC Height & Area Examples for Mass Timber

Occupancy	IV-A	IV-B	IV-C	IV-HT
A-2, A-3	270 ft 18 stories 405,000 to 708,750 gsf	180 ft 12 stories 270,000 to 472,500 gsf	85 ft 6 stories 168,750 to 295,312 gsf	85 ft 4 stories 135,000 to 236,250 gsf
B	270 ft 18 stories 972,000 to 1,701,000 gsf	180 ft 12 stories 648,000 to 1,134,000 gsf	85 ft 9 stories 405,000 to 708,750 gsf	85 ft 6 stories 324,000 to 567,000 gsf
M	270 ft 12 stories 553,500 to 968,625 gsf	180 ft 8 stories 369,000 to 645,750 gsf	85 ft 6 stories 230,625 to 403,593 gsf	85 ft 5 stories 184,500 to 322,875 gsf
R-1, R-2	270 ft 18 stories 553,500 to 968,625 gsf	180 ft 12 stories 369,000 to 645,750 gsf	85 ft 8 stories 230,625 to 403,593 gsf	85 ft 5 stories 184,500 to 322,875 gsf

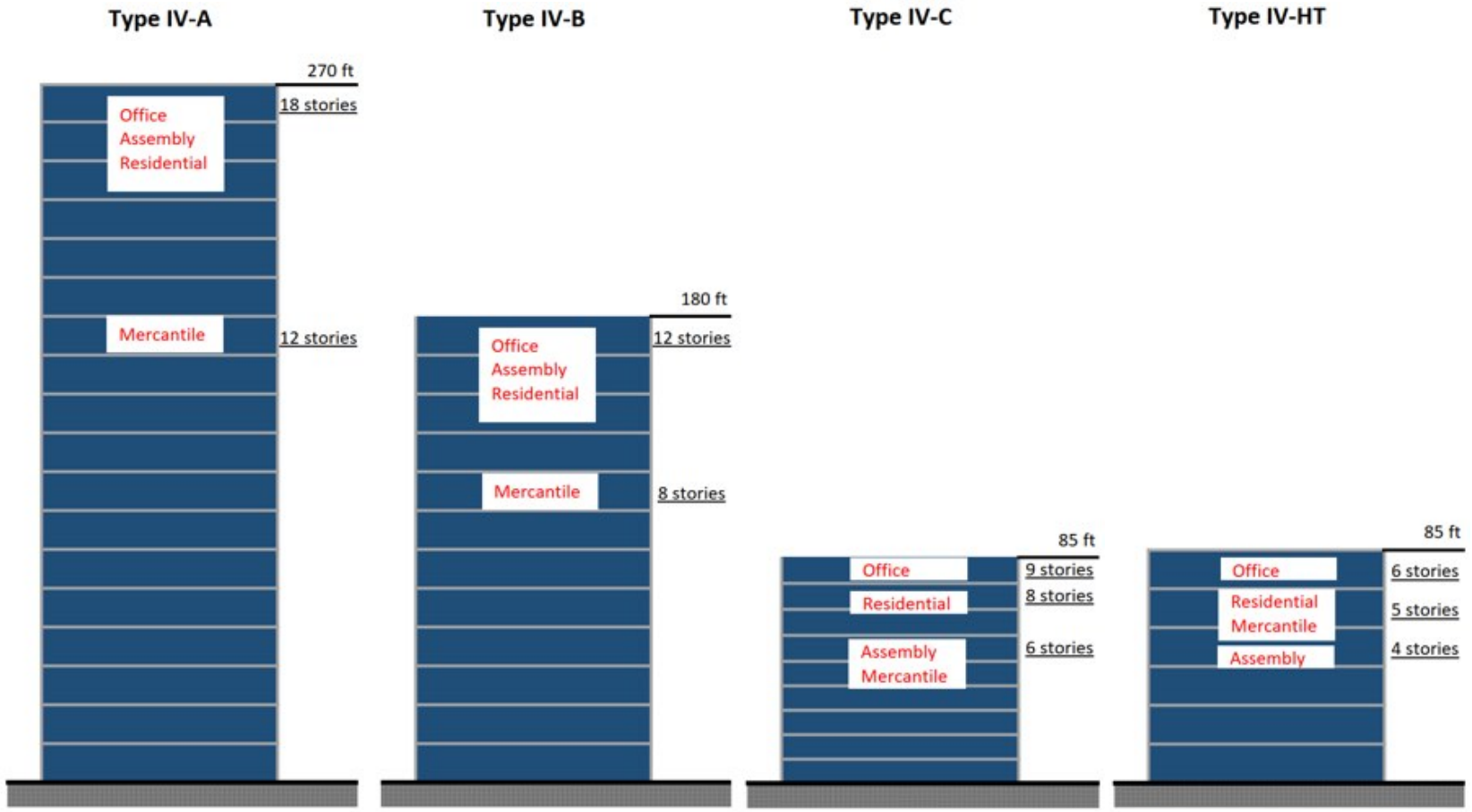
Residential Mixed Use Situations



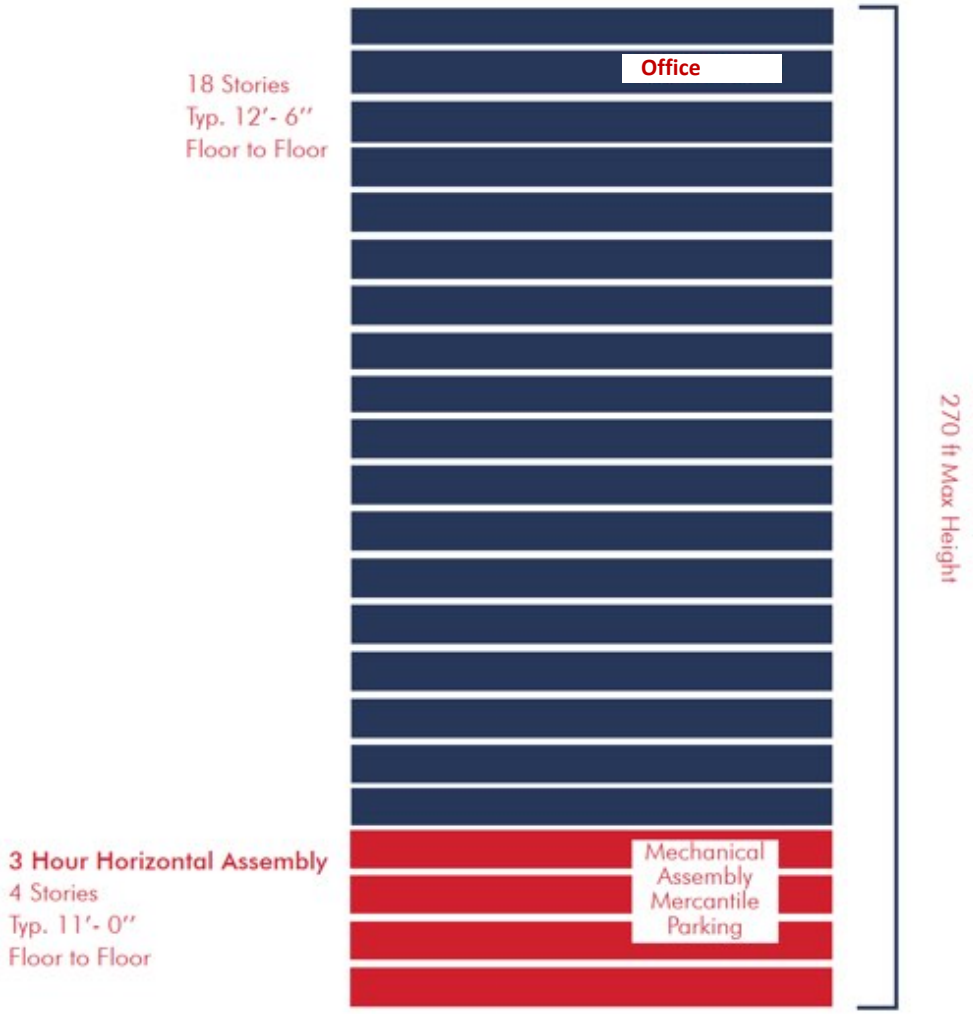
Residential Using Podium Construction



Office Mixed Use Situations



Office Using Podium Construction



High-Rise Building Features for Mass Timber

IBC Section 403

- Secondary on-site water supply if located in Seismic Design Category C, D, E, or F
- Emergency voice/alarm communication system
- Emergency responder radio coverage
- Fire command center
- Post-fire smoke removal
- Standby and emergency power
- Luminous egress path markings in Group A, B, E, I, M, and R-1 occupancies
- Fire pump supplied for two separate mains from different streets, or isolation valve arrangement from one street (All buildings over 420 ft, now includes Type IV-A and IV-B buildings over 120 ft)
- Fire service access elevator for buildings with an occupied floor over 120 ft above the lowest level of fire department vehicle access

Mass Timber Early Adoption Strategies

- Alternative materials, design and methods of construction equipment (IBC 104.11)
- Board of appeal variance (IBC Section 113)

QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

Jay Ierardi, PhD, PE

AKF Group LLC

jierardi@akfgroup.com