



T3
Minneapolis, United States
7 Stories
2016



Carbon 12
Portland, United States
6 Stories
2016



Dalston Lane
London, UK
16 Stories
2018



**Brock Commons
Tallwood House**
Vancouver, Canada
18 Stories
2017

Progressive Wood Construction: The Evolution from Low-Rise to Tall Wood

Presented by Terry Pattillo, AIA – WoodWorks Regional Director

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



Course Description

As a structural building material, wood has been a staple in the US for hundreds of years. However, recent decades have seen a dramatic change in the type and scale of wood projects. As codes have evolved due to recognition of the fire and life safety, structural, and resilient capabilities of wood-construction, new doors have opened that allow larger and taller wood buildings. Concurrently, advances in the technology behind the production of wood products and components have led to the introduction and increased use of off-site construction and mass timber. This opening plenary will take attendees through the progression of wood construction—from light-frame low-rise, to mid-rise, to mass timber and tall wood. With an emphasis on design topics and code provisions applicable to all of these building scales, this session will set the stage for the in-depth technical talks taking place throughout the day.

Learning Objectives

1. Evaluate the code opportunities for cost-effective wood-frame structures in residential mid-rise projects utilizing offsite construction techniques.
2. Understand the distinctive design opportunities in mid-rise commercial construction.
3. Review potential benefits associated with off-site wood construction including cost and schedule savings, worker safety and fire and life safety performance.
4. Discuss unique aspects of mass timber design and construction related to material procurement, on-site inspections, building official interaction, and installation techniques.

Outline

- Need for Wood Construction & Urban Densification
- Building Types/Configurations/Maximizing Height & Area
- Podium Provisions
- Energy Efficiency
- Off-Site Construction
- New Tall Wood Provisions

GLOBAL POPULATION BOOM



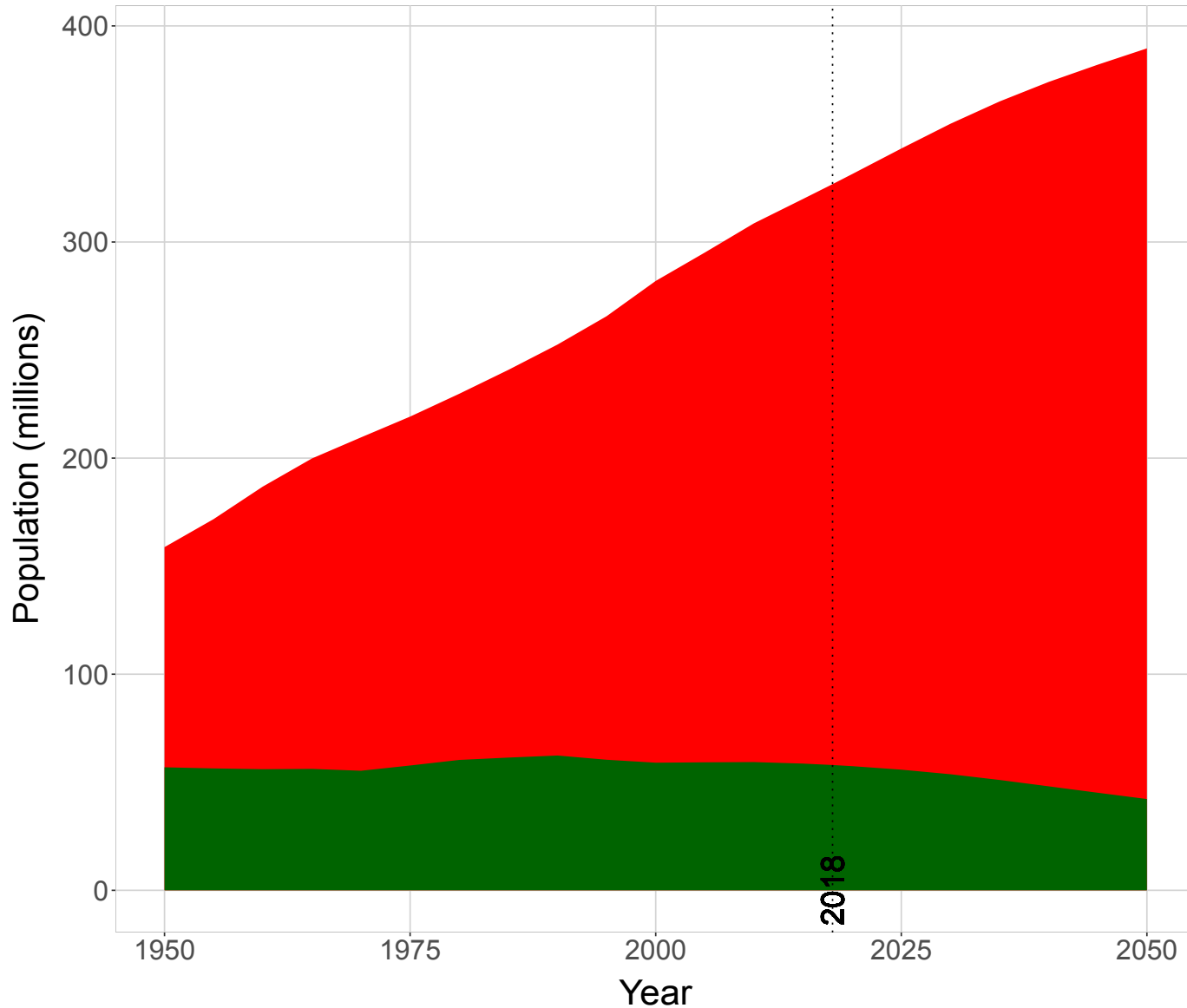
Global Population
7.6 billion now
9.8 billion by 2050
30% increase

Source: United Nations Department
of Economic and Social Affairs

Urban and rural population

United States of America

Urban Rural



US URBAN POPULATION BOOM



URBAN



RURAL

2019

271.4 M

57.7 M

2030

301 M

53.7 M

2050

347.3 M

42.2 M



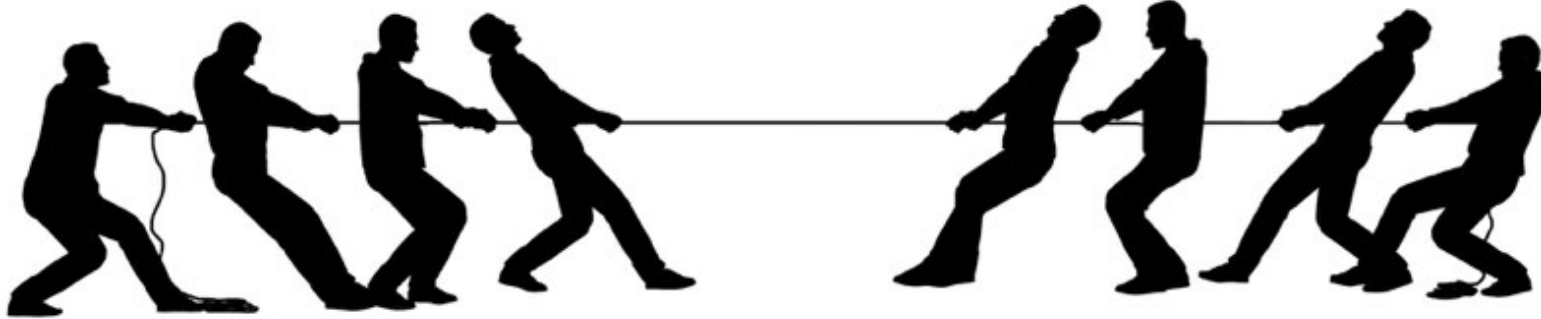
Construction Traffic & Noise
Material Stockpiles
Labor Costs
Labor Availability
Weather Risks



Resiliency
Sustainability
Fire & Life Safety



> Need for Sustainable Structures



Economically Meet
Urban Housing and
Business Needs

Increase
Environmental
Responsibility

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

Just Scratching the Surface

Type V Construction

Type V Buildings

Multi-family



Restaurants



Retail



Office

V-B

Type V-B Height and Area Limits

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	2	60 ft	18,000 SF	36,000 SF
B	3	60 ft	27,000 SF	81,000 SF
M	2	60 ft	27,000 SF	54,000 SF
R-2	3	60 ft	21,000 SF	63,000 SF

Stories/Heights/Areas include allowable increases for sprinklers, but exclude potential frontage increase

1-story retail and restaurants

2 to 3-story residential/office

No fire resistance ratings required



V-A

Type V-A Height and Area Limits



Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	3	70 ft	34,500 SF	103,500 SF
B	4	70 ft	54,000 SF	162,000 SF
M	4	70 ft	42,000 SF	126,000 SF
R-2	4	70 ft	36,000 SF	108,000 SF

Stories/Heights/Areas include allowable increases for sprinklers, but exclude potential frontage increase

3 to 4-story residential/office

1-hour fire resistance rating required for most building elements

Let's Go a Little Bigger

Type III Construction

Type III Buildings

Multi-family



K-12/Higher Ed



Hospitality



Office

III-B

Type III-B Height and Area Limits

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	3	75 ft	28,500 SF	85,500 SF
B	4	75 ft	57,000 SF	171,000 SF
M	3	75 ft	37,500 SF	112,500 SF
R-2	5	75 ft	48,000 SF	144,000 SF

Stories/Heights/Areas include allowable increases for sprinklers, but exclude potential frontage increase

4-story office / 5-story residential

2-hour fire resistance rating required for exterior bearing walls only (non combustible or FRT construction)

III-A

Type III-A Height and Area Limits



Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	4	85 ft	42,000 SF	126,000 SF
B	6	85 ft	85,500 SF	256,500 SF
M	5	85 ft	55,500 SF	166,500 SF
R-2	5	85 ft	72,000 SF	216,000 SF

Stories/Heights/Areas include allowable increases for sprinklers, but exclude potential frontage increase

5-story residential / 6-story office

2-hour rating for exterior bearing walls

1-hour rating for other building elements

Any Bigger?

Type IV Construction

Type IV Buildings

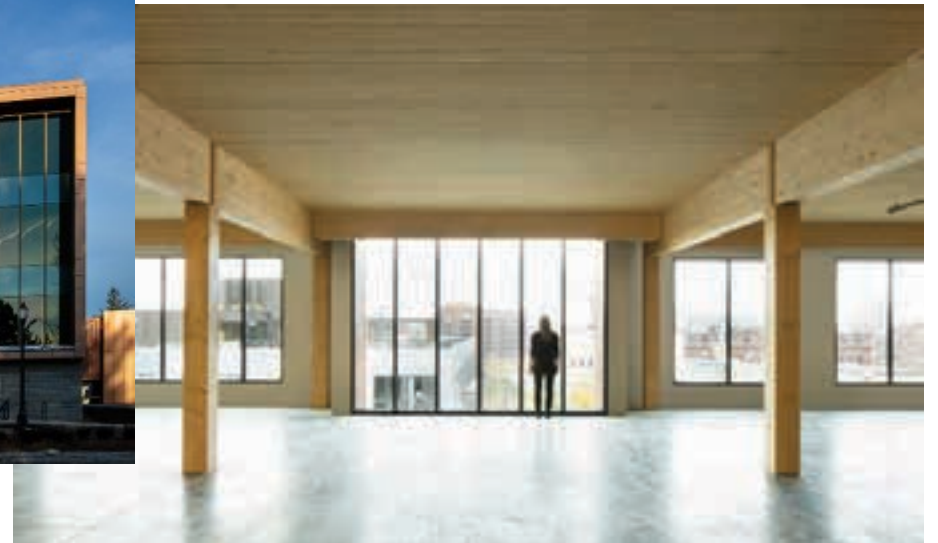
Mixed-Use



Higher Education



Office



Type IV-HT Height and Area Limits

IV-HT



Credit: John Staments

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	4	85 ft	45,000 SF	135,000 SF
B	6	85 ft	108,000 SF	324,000 SF
M	5	85 ft	61,500 SF	184,500 SF
R-2	5	85 ft	61,500 SF	184,500 SF

Stories/Heights/Areas include allowable increases for sprinklers, but exclude potential frontage increase

5-story residential / 6-story office

2-hour rating for exterior bearing walls

Interior elements must qualify as Heavy Timber

Let's Push It To The Limit

Podiums

Podium Limits



IBC	# of Podium Levels	Podium Occupancy
2009	1	S-2 Parking
2012	1	A, B, M, R or S-2 Parking
2015	Multi-story	A, B, M, R or S-2 Parking
2018	Multi-story	A, B, M, R or S-2 Parking

3-hour building separation

Pushed light-framed wood to the limits of code allowed heights

Leveraging Thermal Benefits

Wood's Advantages for Energy Efficiency

Energy Efficiency

- Energy codes continue to evolve, requiring enhanced levels of energy efficiency
- Recognition of wood's superior thermal properties

TABLE C402.1.3

OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^a

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other
Walls, above grade											
Mass	R-5.7ci ^b	R-5.7ci ^b	R-5.7ci ^b	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci
Metal building	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci

Energy Efficiency

Techniques such as **Passive House** can be paired with **Wood's** inherent thermal benefits to gain greater savings

- Minimize Thermal Bridging
- Continuous air barrier
- High performance glazing
- Balanced air intake & heat recovery mechanical systems

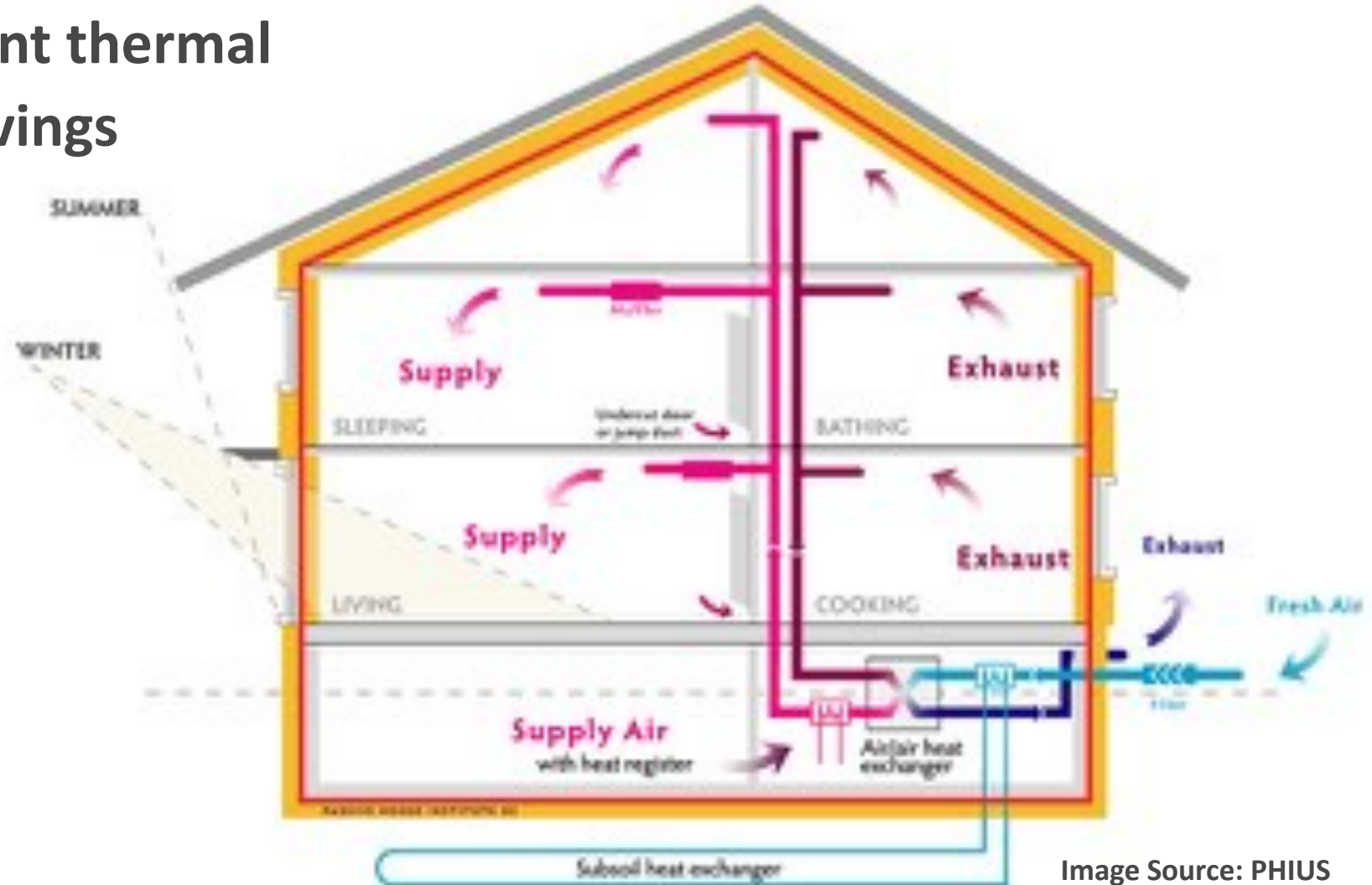


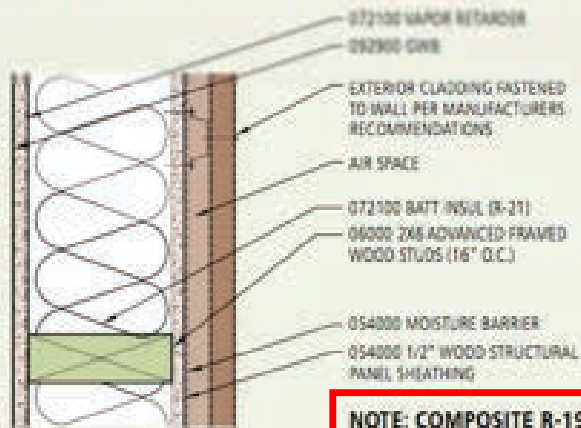
Image Source: PHIUS



- Finding value in utilizing wood in "non-wood" levels
- Wood framing within Podium Levels

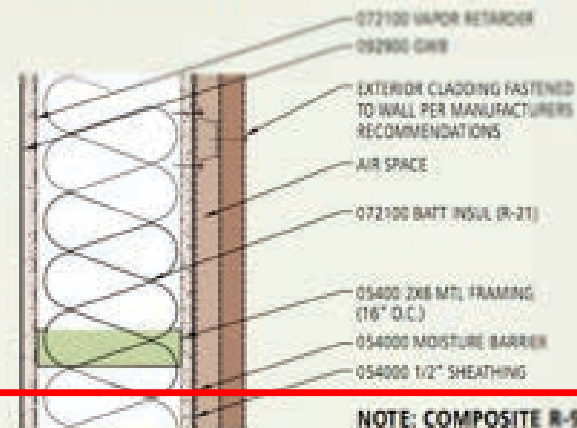


2X6 WOOD STUDS W/ R-21 BATT INSULATION



NOTE: COMPOSITE R-19 +/-

2X6 MTL STUDS W/ R-21 BATT INSULATION



NOTE: COMPOSITE R-9 +/-

How is Design Shifting?

Off-Site Construction



Varying Degrees of Automated Equipment

Panelized Construction



Image: Blueprint Robotics

Prefabricated Construction



Image: Ecocor

33% Schedule Savings



Woodlands at Harvest Hill, Lebanon, NH
4 Stories, 167k SF

Image: Trumbull-Nelson Construction Company
Source: Wallace Building Products³

MODULAR CONSTRUCTION



Image: Guerdon Modular

Modular Construction



Image: Guerdon Modular

Modular Construction



Image: Guerdon Modular

What's Happening Across The Globe?

Tall Wood

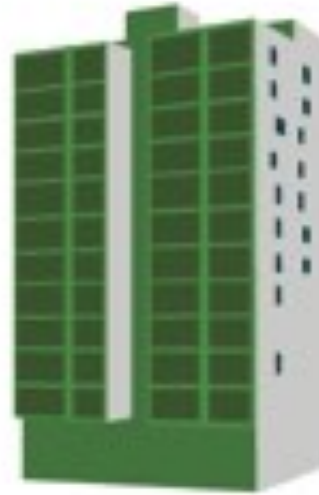
International Tall Wood Projects



Murray Grove
London, United Kingdom
8 Stories
2009



Forté
Melbourne, Australia
10 Stories
2012



TREET
Bergen, Norway
14 Stories
2015



Brock Commons
Vancouver, Canada
18 Stories
2017

What Will The Future Bring?

Tall Wood in the US

IBC 2021

NEW CONSTRUCTION TYPES IN 2021 IBC

Type IV-A – Maximum 18 stories, with gypsum wallboard on all mass timber.

Type IV-B – Maximum 12 stories, limited-area of exposed mass timber walls and ceilings allowed.

Type IV-C – Maximum 9 stories, all exposed mass timber designed for a 2-hour fire resistance.



Type IV-C



9 STORIES
BUILDING HEIGHT 85'
ALLOWABLE BUILDING AREA 405,000 SF
AVERAGE AREA PER STORY 45,000 SF

TYPE IV-C



Credit: Susan Jones, atelierjones

Photos: Baumberger Studio/PATH
Architecture/Marcus Kauffman

IV-C

Type IV-C Height and Area Limits

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	6	85 ft	56,250 SF	168,750 SF
B	9	85 ft	135,000 SF	405,000 SF
M	6	85 ft	76,875 SF	230,625 SF
R-2	8	85 ft	76,875 SF	230,625 SF

Areas exclude potential frontage increase

In most cases, Type IV-C height allowances = Type IV-HT height allowances, but add'l stories permitted due to enhanced FRR

Type IV-C area = 1.25 * Type IV-HT area



9 STORIES
BUILDING HEIGHT 85'
ALLOWABLE BUILDING AREA 405,000 SF
AVERAGE AREA PER STORY 45,000 SF

TYPE IV-C

Type IV-B



12 STORIES
BUILDING HEIGHT 180 FT
ALLOWABLE BUILDING AREA 648,000 SF
AVERAGE AREA PER STORY 54,000SF

TYPE IV-B

Credit: Susan Jones, atelierjones



Credit: LEVER Architecture



IV-B

Type IV-B Height and Area Limits

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	12	180 ft	90,000 SF	270,000 SF
B	12	180 ft	216,000 SF	648,000 SF
M	8	180 ft	123,000 SF	369,000 SF
R-2	12	180 ft	123,000 SF	369,000 SF

Areas exclude potential frontage increase

In most cases, Type IV-B height & story allowances = Type I-B height & story allowances

Type IV-B area = 2 * Type IV-HT area



12 STORIES
BUILDING HEIGHT 180 FT
ALLOWABLE BUILDING AREA 648,000 SF
AVERAGE AREA PER STORY 54,000 SF

TYPE IV-B

Credit: Susan Jones, atelierjones

Type IV-A



18 STORIES
BUILDING HEIGHT 270'
ALLOWABLE BUILDING AREA 972,000 SF
AVERAGE AREA PER STORY 54,000SF

TYPE IV-A

Credit: Susan Jones, atelierjones



Photos: Structurlam, naturally:wood,
Fast + Epp

Type IV-A Height and Area Limits



18 STORIES
BUILDING HEIGHT 270'
ALLOWABLE BUILDING AREA 972,000 SF
AVERAGE AREA PER STORY 54,000SF

TYPE IV-A

Occupancy	# of Stories	Height	Area per Story	Building Area
A-2	18	270 ft	135,000 SF	405,000 SF
B	18	270 ft	324,000 SF	972,000 SF
M	12	270 ft	184,500 SF	553,500 SF
R-2	18	270 ft	184,500 SF	553,500 SF

Areas exclude potential frontage increase

In most cases, Type IV-A height & story allowances = 1.5 * Type I-B height & story allowances

Type IV-A area = 3 * Type IV-HT area

QUESTIONS?

This concludes The
American Institute of
Architects Continuing
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Course

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