Mass Timber

Building Bigger with Wood

Light Frame and Heavy Timber

- Residential & light commercial
- Thousand-year history
- Significant market coverage
- Height limited

U.S. Light Frame Limits

Per International Building Code (IBC 2015)

- Five floors or 85 ft with proper sprinkler
- Four floors or 65 ft without sprinkling
- Can gain floors but not height by building on top of "non-combustible" construction

Mass Timber

- Multi-family and tall commercial
- 25-year history
- Just entering N. American markets
- The sky's the limit

Mass timber competes with tilt-up and steel.

Mass Timber Height Limits

- Currently being pushed on a case-by-case basis
- Fire testing and rating underway
- 8-10 stories seen as market niche

Photos by Lend Lease

Mass Timber

Photos by Lend Lease, Roberto Lopez-Anido

Glue-laminated Beams

Photo courtesy Roberto Lopez-Anido

Glue-laminated Beams

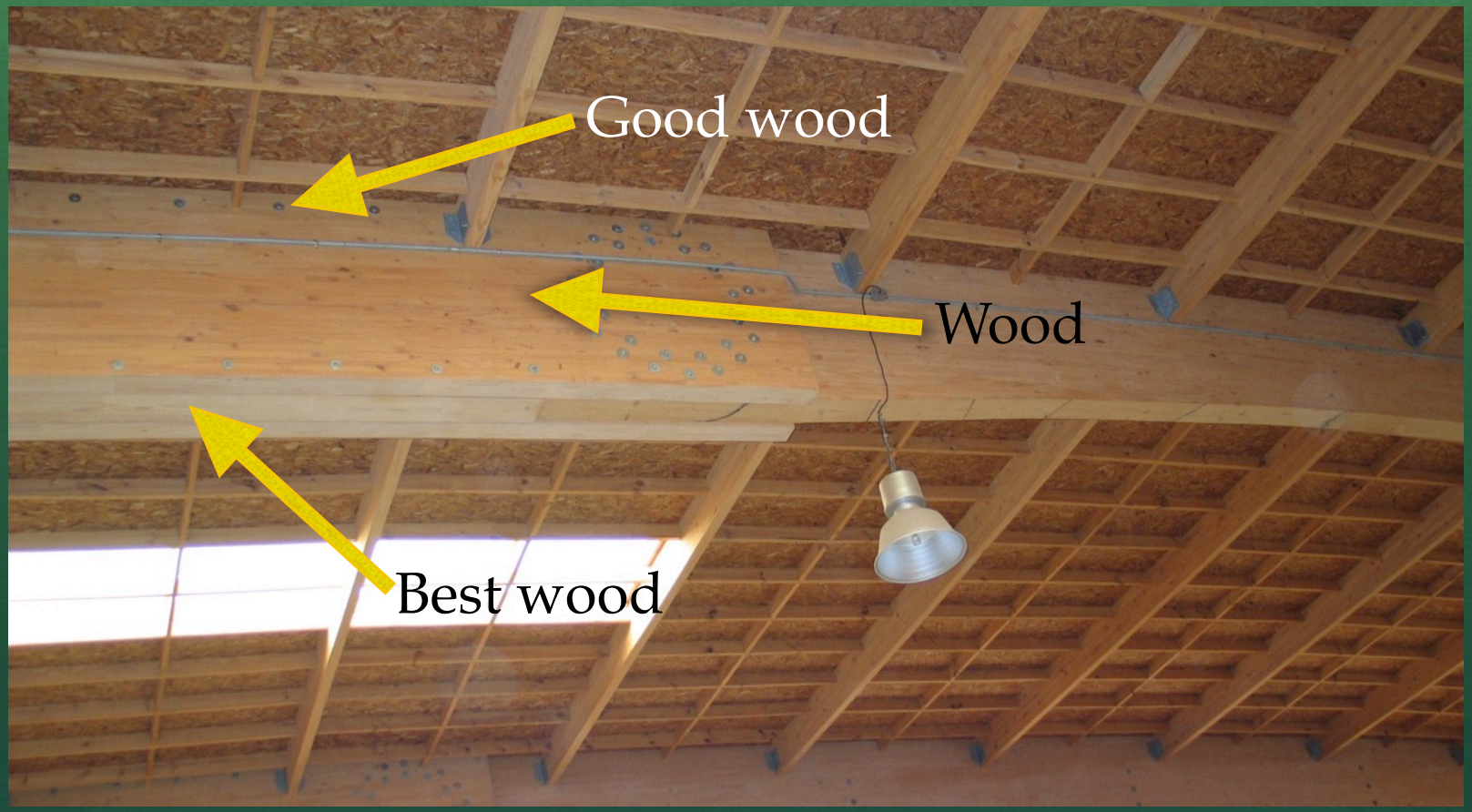
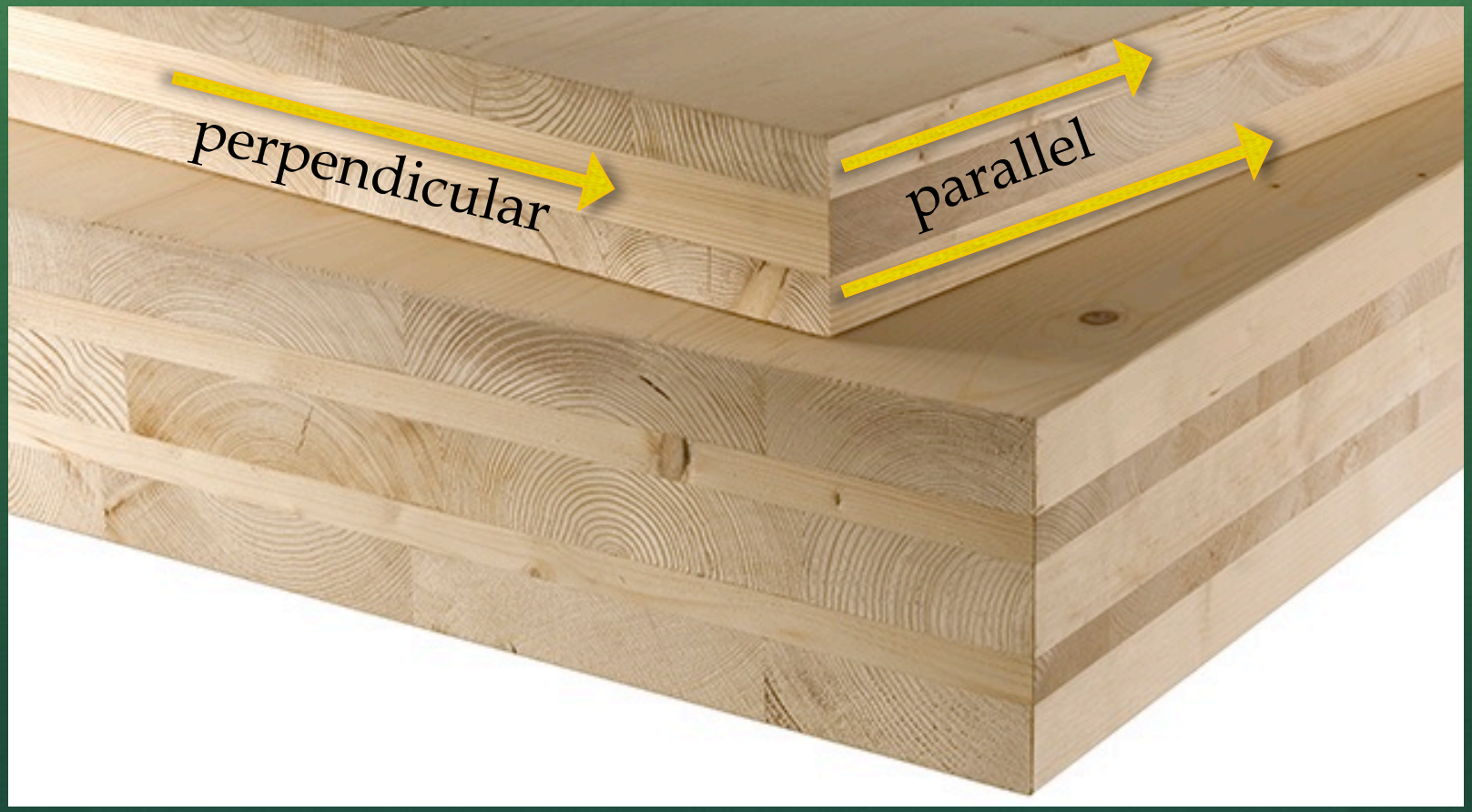


Photo courtesy Roberto Lopez-Anido

Nail Laminated Timber

- Parallel boards
- Plywood sheathing
- Used for horizontal components

Cross-Laminated Timber



Cross-Laminated Timber

- Manufactured in 10 ft x 60 ft (±) sheets
- 3-, 5-, 7-ply common, up to 20" thick possible
- Kiln-dried lumber (MC ≤ 12%)
- Panels custom cut

Cross-Laminated Timber

- Used for buildings
- Often in combination with glulam columns and beams
- Composite floor construction provides greater spans

ANSI/ APA PRG-320

Standard for Performance-Rated Cross-Laminated Timber

"Any softwood lumber species or species combination recognized by American Lumber Standards Committee (ALSC) under PS 20 or Canadian Lumber Standards Accreditation Board (CLSAB) under CSA CSA4141 with a minimum published specific gravity of 0.35, as published in the National Design Specification for Wood Construction (NDS) in the U.S. and CSA O86 in Canada, shall be permitted for use in CLT manufacturing provided that other requirements specified in this section are satisfied. The same lumber species or species combination shall be used in a single layer of CLT. Adjacent layers of CLT shall be permitted to be made of different species or species combinations."

ANSI/APA PRG-320

Standard for Performance-Rated Cross-Laminated Timber

"Any softwood lumb… recognized by Am… (ALSC) und… Accredi… mi… in the U… permitted for … other requirem… The same lumber s… used in a sing… be permit… combinati…

Any softwood lumber species…with a minimum published specific gravity of 0.35

Adjacent layers of CLT shall be permitted to be made of different species …

Minimum grade…in the parallel layers…shall be 1200f-1.2E MSR or … No. 2. …[P]erpendicular layers…shall be No. 3 [or better].

Grading (also PRG-320)

Grade	Parallel Layers	Perp
E1	1950f-1.7E SPF MSR	No. 3 SPF
E2	1650f-1.5E Df-L MSR	No. 3 Df-L
E3	1200f-1.2E Eastern Softwoods, Northern Species, or Western Woods MSR	No. 3 of same
E4	1950f-1.7E SP MSR	No. 3 SP
V1	No. 2 Df-L	No. 3 Df-L
V2	No. 1/No. 2 SPF	No. 3 SPF
V3	No. 2 SP	No. 3 SP

New grade for New England?

Grade	Parallel Layers	Perp
E1	1950f-1.7E SPF MSR	No. 3 SPF
E2	1650f-1.5E Df-L MSR	No. 3 Df-L
E3	1200f-1.2E Eastern Softwoods, North… Species, or Western Wo…	…same
E4	1950f-1.…	No. 3 SP
E5	No. 2 Df-L	No. 3 Df-L
V2	No. 1/No. 2 SPF	No. 3 SPF
V3	No. 2 SP	No. 3 SP

1650f-1.5E SPF MSR

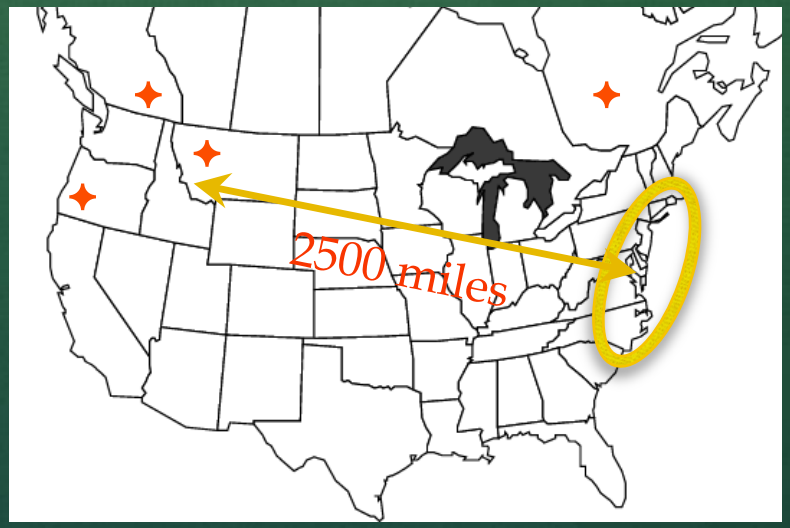
No. 3 SPF

N. American Manufacturers

- SmartLam (Columbia Falls, MT)
- D.R. Johnson (Riddle, OR)
- Nordic (Chibougamau, QC)
- Structurlam (Penticton, BC)

N. American Manufacturers

- SmartLam (Columbia Falls, MT)
- D.R. Johnson (Riddle, OR)
- Nordic (Chibougamau, QC)
- Structurlam (Penticton, BC)



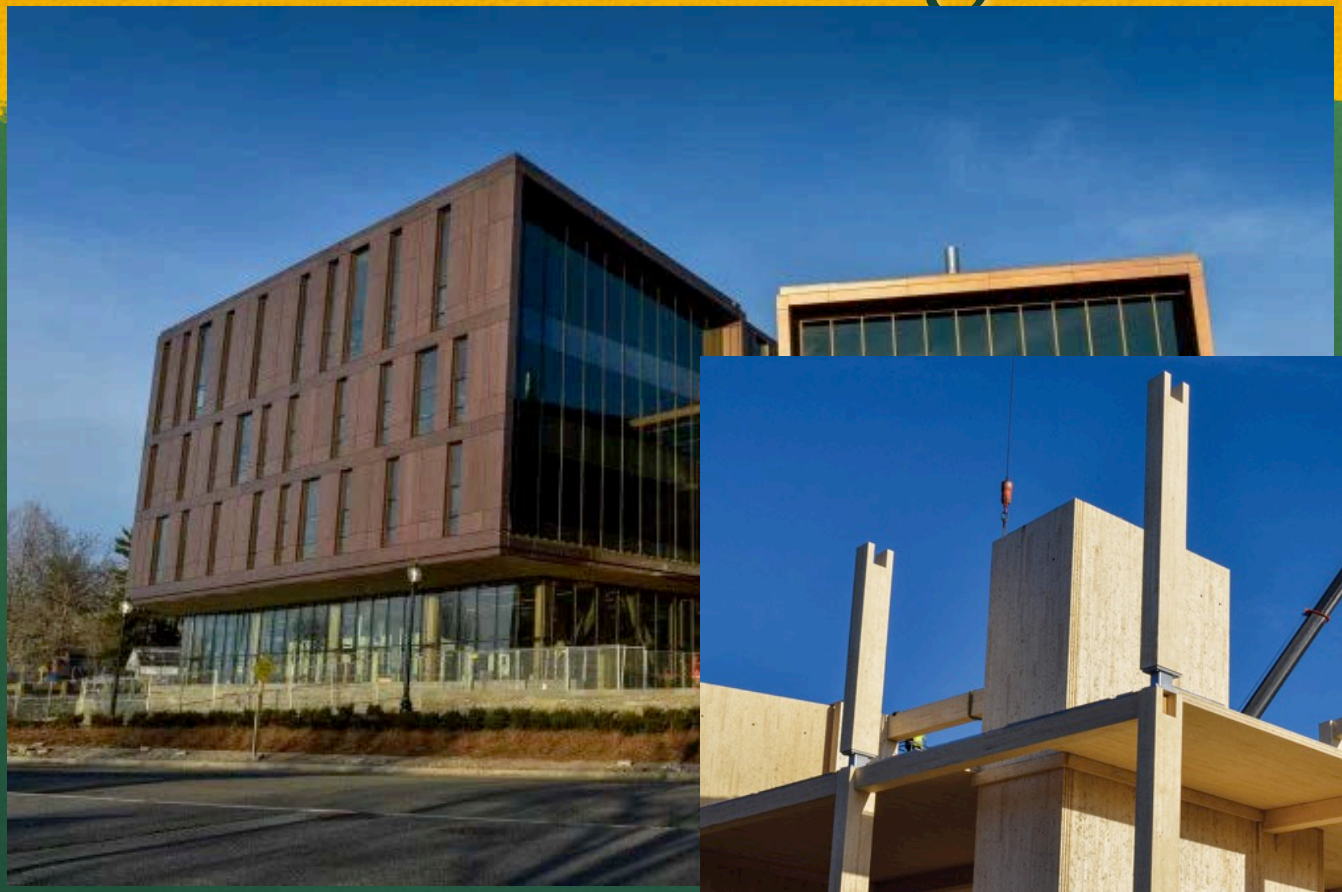
Advantages

- Rapid construction, fewer workers, less traffic
- CO_2 sequestration
- Use of small diameter lumber
- Cost-competitive
- Lightweight → Smaller foundations
- All the good of wood: acoustics, insulation, aesthetics
- Competing with steel and concrete

Code Acceptance

- IBC 2015
- NDS 2015
- Fire ratings underway
- Seismic rating underway
- Preservative treatment

UMass Design Building



Photos by Umass Amherst

UMass Design Building

Contralaminada
Lleida, Spain
8 Stories
2014

Maison de l'Inde
Paris, France
7 Stories
2013

Wagramerstrasse
Vienna, Austria
7 Stories
2013

Puukuokka
Jyväskylä, Finland
8 Stories
2015

Wood Innovation & Design Centre
British Columbia, Canada
8 Stories
2014

Bridport House
London, UK
8 Stories
2010

Cenni di Cambiamento
Milan, Italy
9 Stories
2013

Forté
Melbourne, Australia
10 Stories
2012

Panorama Giustinelli
Triste, Italy
7 Stories
2013

St. Dié-des-Vosges
St. Dié-des-Vosges
8 Stories
2014

Strandparken
Stockholm, Sweden
8 Stories
2014

Pentagon II
Oslo, Norway
8 Stories
2013

LifeCycle Tower One
Dornbirn, Austria
8 Stories
2012

Cenni di Cambiamento
Milan, Italy
9 Stories
2013

Moholt 50/50
Trondheim, Norway
9 Stories
2016

Holz8
Batabling, German
8 Stories
2011

Arbora
Montréal, Canada
8 Stories
2016

TREET
Bergen, Norway
14 Stories
2015

Trafalgar Place
London, UK
10 Stories

T3
Minnesota, United States
7 Stories
2016

Banyan Wharf
London, UK
10 Stories
2015

5 King
Australia
10 Stories
Under Construction

Silva
Bordeaux, France
18 Stories
Under Construction

Mjøstårnet
Norway
18 Stories
Under Construction

Dalston Lane
London, UK
9 Stories
2017

Sida Vid Sida
Skelleftea, Sweden
19 Stories
Announced

Brock Commons Tallwood House
Vancouver, Canada
18 Stories

Origine Condos
Quebec City, Canada
13 Stories
2017

Carbon 12
Portland, United States
8 Stories
Design Phase

Framework
Portland, United States
12 Stories
Design Phase

Shamelessly taken from http://www.rethinkwood.com/tall-wood-mass-timber/tall-wood-gallery

Shamelessly taken from http://www.rethinkwood.com/tall-wood-mass-timber/tall-wood-gallery

Shamelessly taken from http://www.rethinkwood.com/tall-wood-mass-timber/tall-wood-gallery

Shamelessly taken from http://www.rethinkwood.com/tall-wood-mass-timber/tall-wood-gallery

Shamelessly taken from http://www.rethinkwood.com/tall-wood-mass-timber/tall-wood-gallery

Candlewood Suites

Candlewood Suites

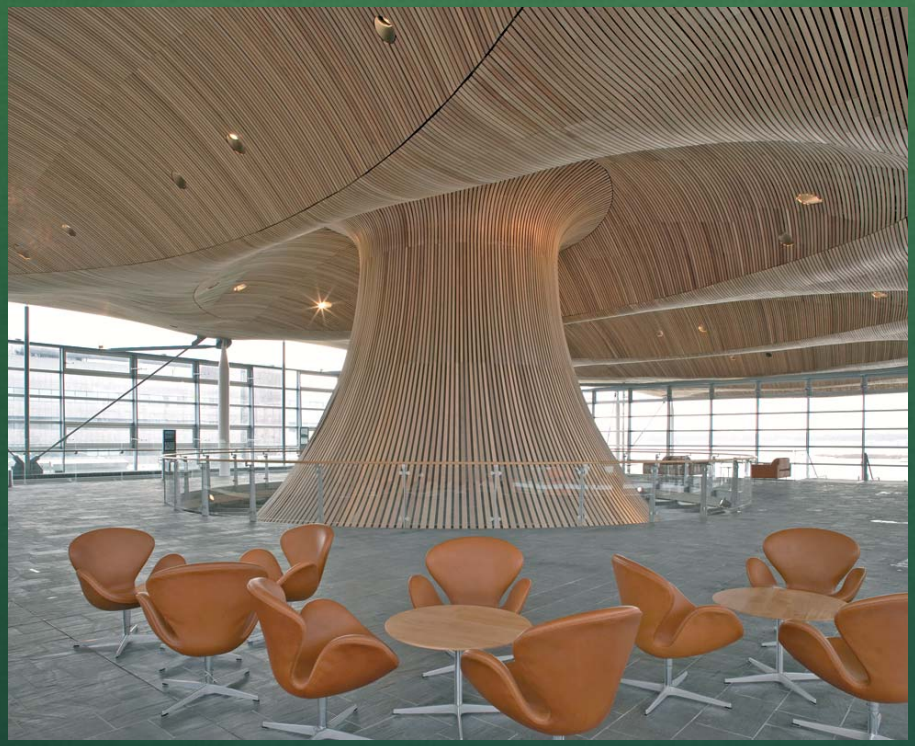
- 37% savings in construction time for the structure—using first time crew
- 20% overall reduction in construction schedule
- 44% savings in labor-hours
- 1557 CLT panels, 11 GL columns, 44 GL beams

Designed for Blast

Candlewood Suites

- 935,696 bd ft equiv.
- 5 minutes of US and Canada growth

Questions



?

References

- CLT Handbook (free from reThinkWood.com)
- Case studies
  - WoodWorks.com
  - Smith, *et al*. Solid Timber Construction: Process, Practice, Performance
- Production: R. Brander 2013. *Production and Technology of Cross Laminated Timber (CLT): A state-of-the-art report*