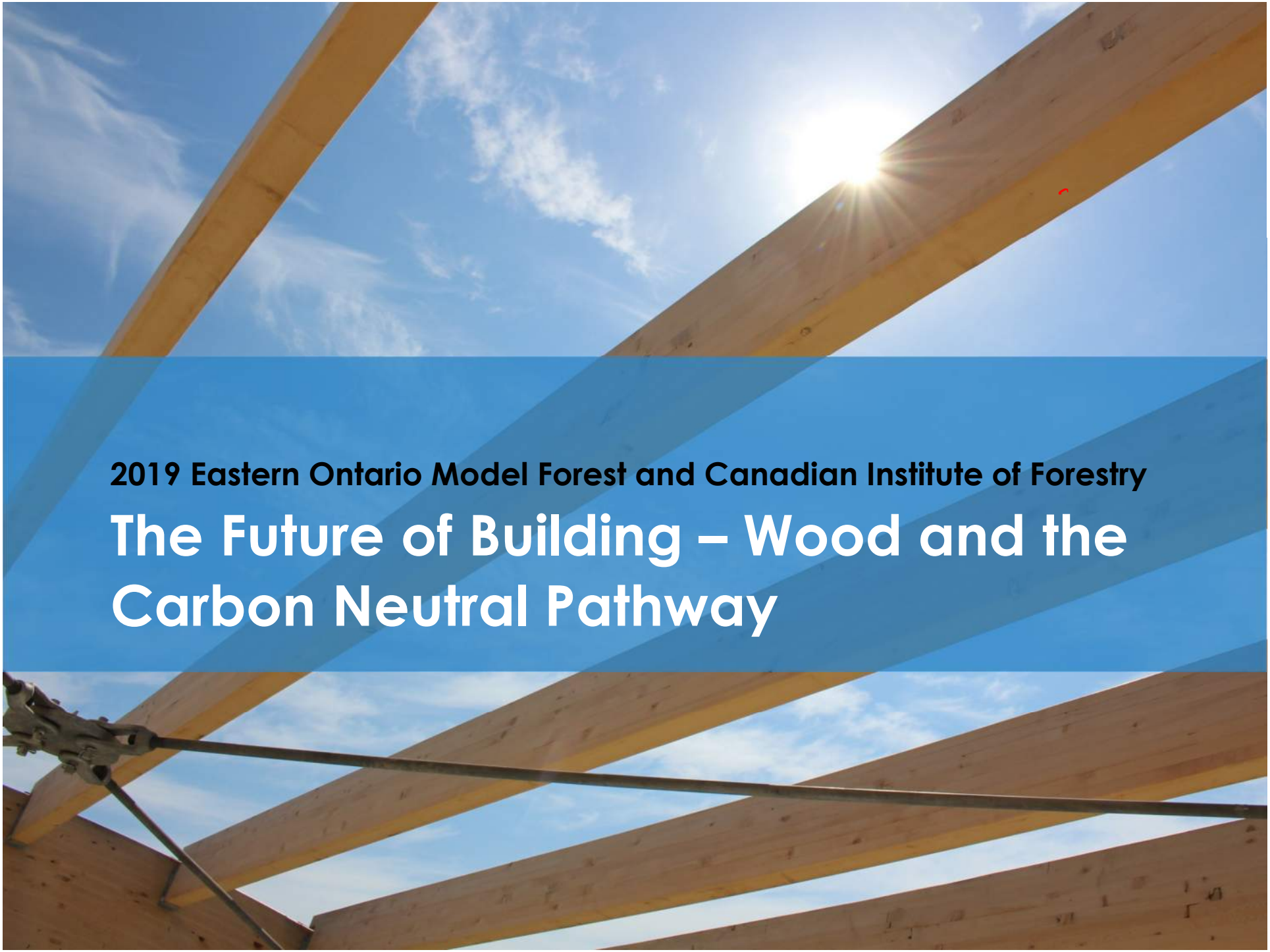


2019 Eastern Ontario Model Forest and Canadian Institute of Forestry

The Future of Building – Wood and the Carbon Neutral Pathway

moses structural
engineers

David Moses, PhD, PEng, PE, LEED® AP

Principal
Moses Structural Engineers Inc.
Toronto, ON

OVERVIEW

1. Carbon
2. Kit of Parts, Tech, Prefab
3. Mass Timber Buildings
4. Education & Training

SECTION 1

Carbon

ESTIMATED ENVIRONMENTAL IMPACT OF WOOD USE

Volume of wood products used:
2,233 cubic meters of CLT and Glulam

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

Carbon stored in the wood:
1,753 metric tons of CO_2

Avoided greenhouse gas emissions:
679 metric tons of CO_2

Total potential carbon benefit:
2,432 metric tons of CO_2

THE ABOVE GHG EMISSIONS ARE EQUIVALENT TO:

511 cars off the road for a year

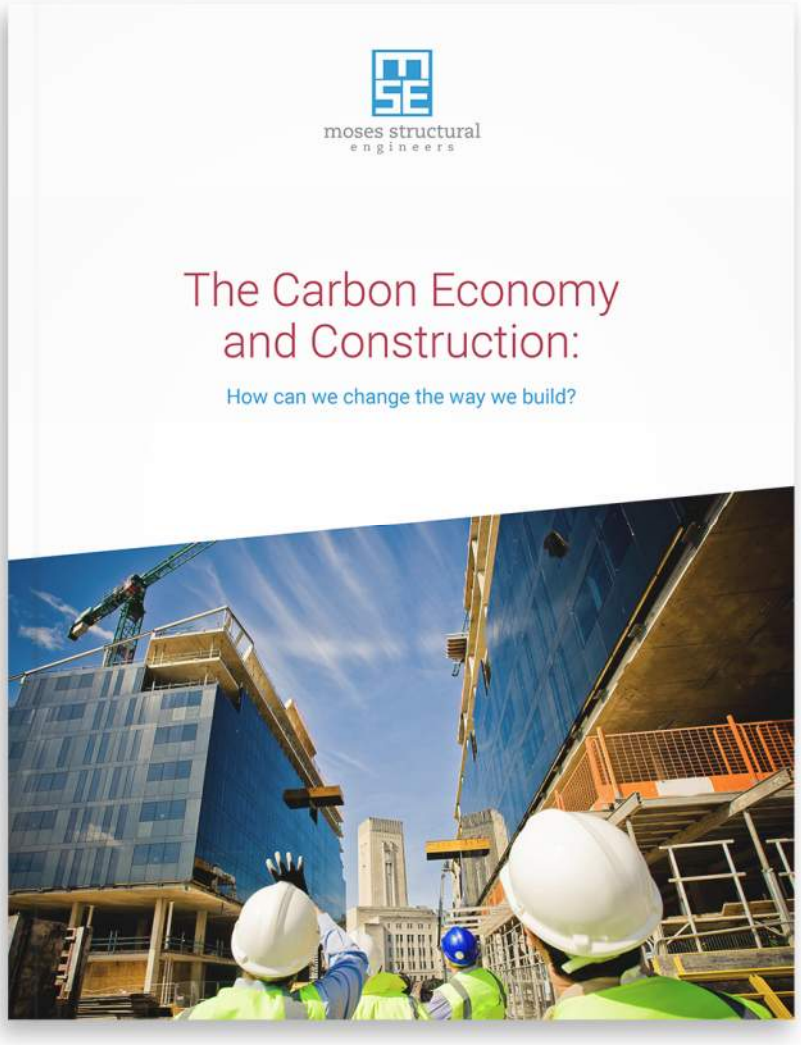
Energy to operate a home for **222** years

**Estimated by the Wood Carbon Calculator for Buildings, based on research by Sathre, R. and J. O'Connor, 2010, A Synthesis of Research on Wood Products and Greenhouse Gas Impacts, FPInnovations (this relates to carbon stored and avoided GHG).*

**CO2 in this case study refers to CO2 equivalent*

Table 1. Brock Commons, Vancouver. Source: rethinkWood.com

The Carbon Economy and Construction



TIMBERFEVER

moses structural
engineers

Carbon demands

Building operational energy

- Over 50-100 year building lifespan
- Increases over time

Building EMBODIED energy

- Materials extraction, processing, construction
- 100% realized on opening day
- And again when components replaced (e.g. roofing, windows)

TIMBERFEVER

moses structural engineers

Options

Concrete

- Accounts for about 7% global CO2 GHG (cement)

Aluminum and glass

- Facades
  - Global sand shortages
  - High embodied energy
  - Replaced every 20-30 years

Wood and Plants

- Energy from sun
- Absorbs CO2 from atmosphere

TIMBERFEVER

moses structural engineers

Does this matter in Canada?

10th largest GHG emitter in world, 2015

4TH largest global producer of oil

One of the highest per capita emissions globally

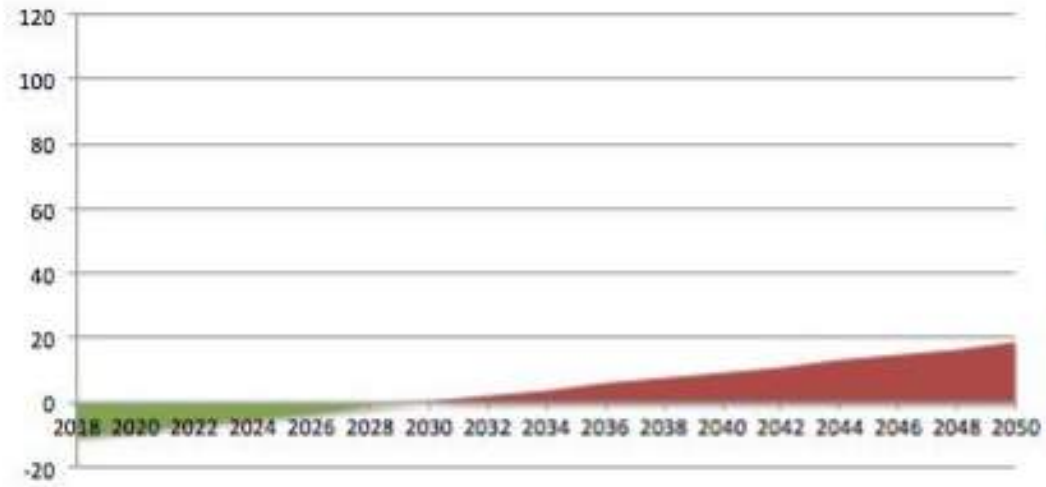
- **Targetting 30% reductions by 2030 (compared to 2015)**
- **Targetting 100% by 2040**

TIMBERFEVER

moses structural engineers

Straw-clay, or straw-bale

Sample Study
Natural materials, high performance



Ontario high perf. natural build

R-20/30/40/60

EC = -10.5 tons CO2e

Nat. gas heat = 0.9 tons/yr

18.3 tons @ 2050

TIMBERFEVER

moses structural engineers

Source: Chris Magwood – Endeavour Centre – chris@endeavourcentre.org

Trees

Sequester = Absorb

2 cubic metres of wood

=

1 ton

=

1 tonne CO_2 removed from atmosphere

TIMBERFEVER

moses structural engineers

100 YEAR OLD
Tall Wood Buildings in Toronto

TIMBERFEVER

moses structural
engineers

100 YEAR OLD
Tall Wood Buildings in Toronto

TIMBERFEVER

moses structural
engineers

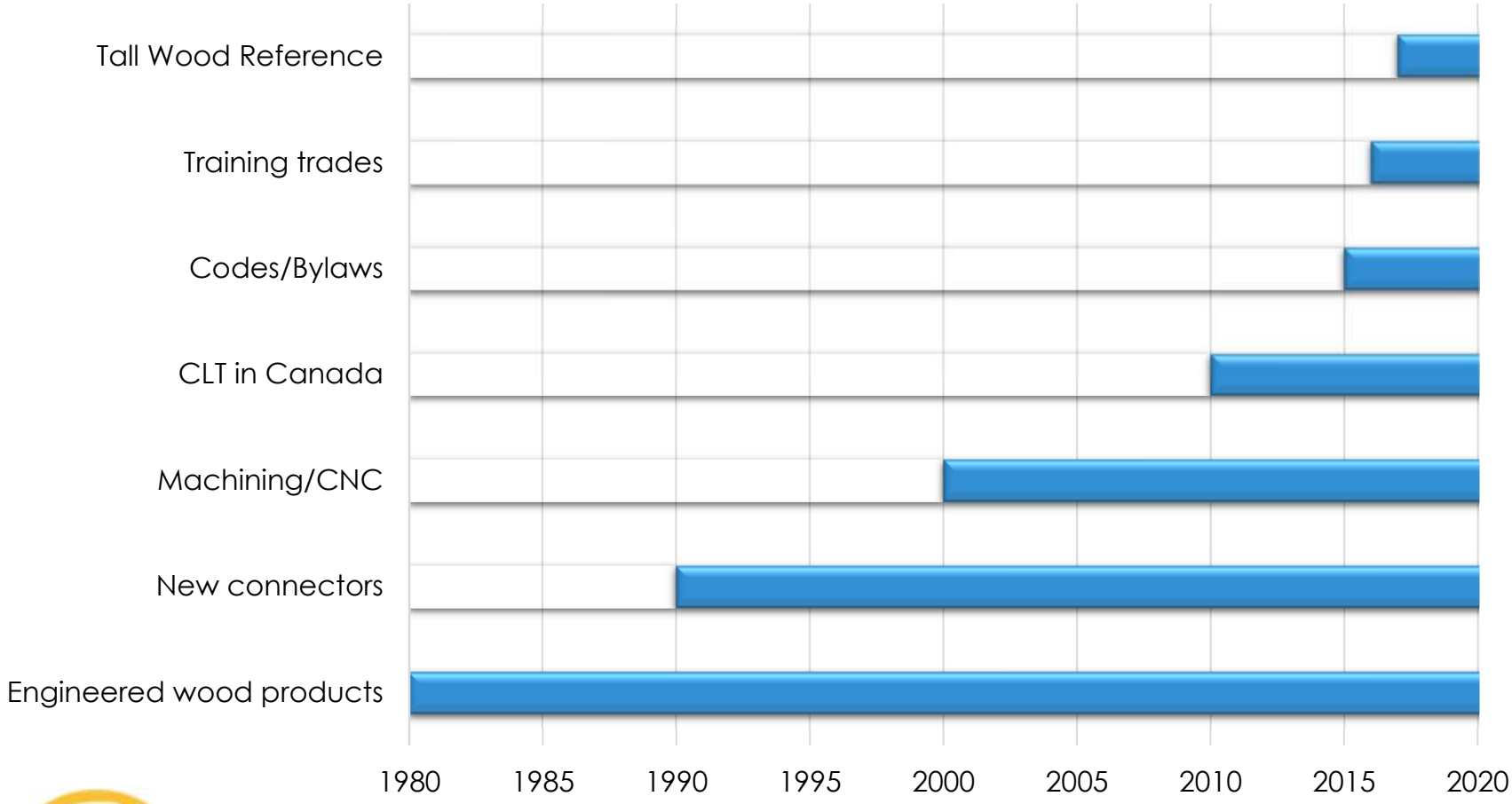
SECTION 2

Kit of Parts, Technology, Prefabrication

Nail Laminated Timber (NLT)

Image source: www.ThinkWood.com

Advances in Timber Engineering



TIMBERFEVER

moses structural

Image source: www.ThinkWood.com

Engineered Wood: Glulam Lumber

TIMBERFEVER

moses structural
engineers

1980's Engineered Wood:
LVL – laminated veneer lumber

TimberStrand® - LSL

Parallam® - PSL

TIMBERFEVER

moses structural engineers

2018:

MPP – mass plywood panel

moses structural
engineers

2000 1st CNC, Canada

Courtesy: Structurlam Products Ltd., Penticton, BC

2000 1st CNC, Canada

Courtesy: Structurlam Products Ltd., Penticton, BC

Cross-laminated Timber (CLT)

- Solid wood panel
- Many applications
- Better strength
- Better fire resistance
- Dimensionally stable
- Speed of construction

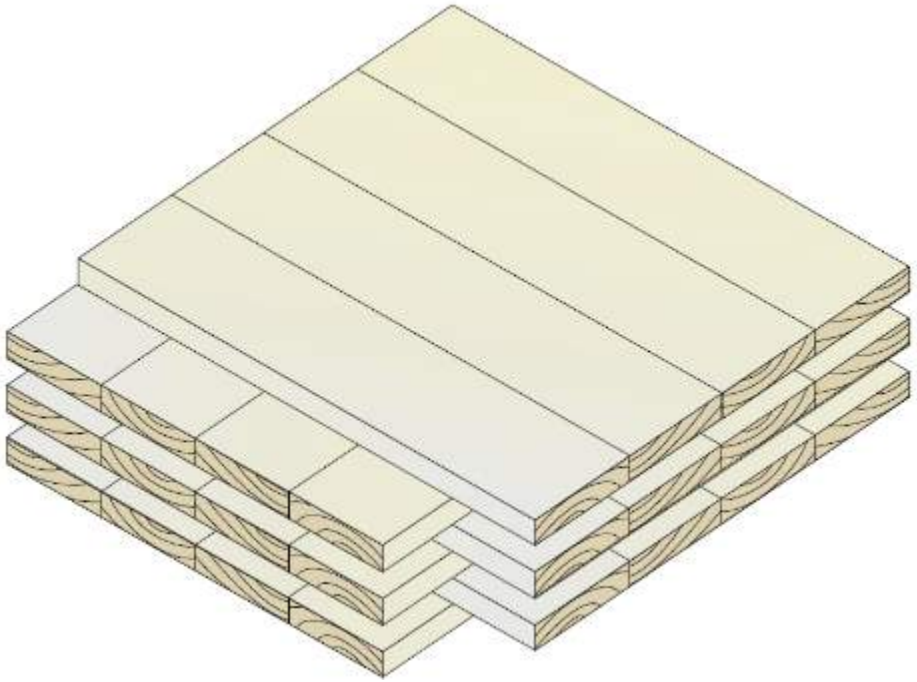


Image source: FPInnovations

TIMBERFEVER

moses structural

Cross-laminated timber (CLT)

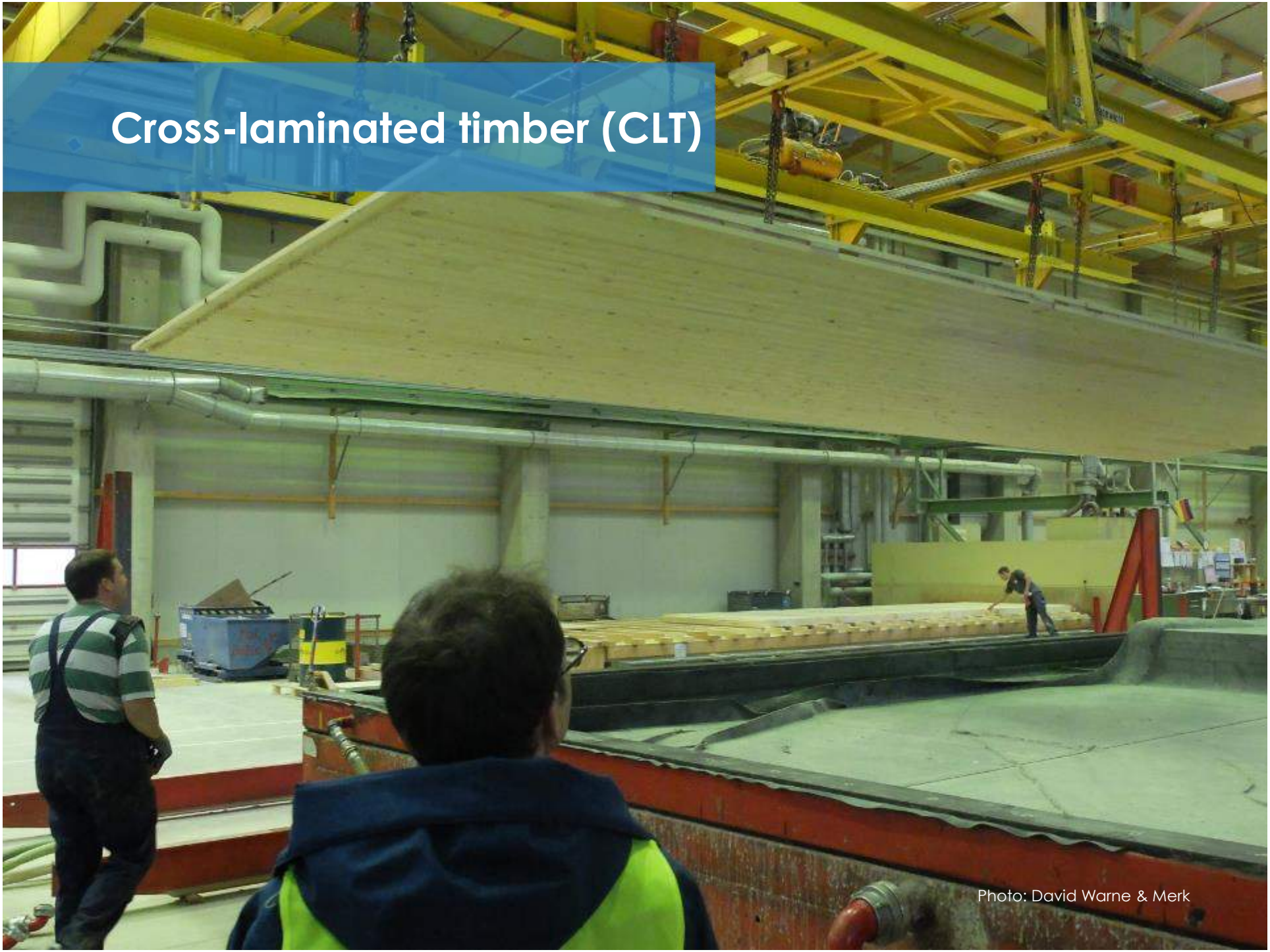


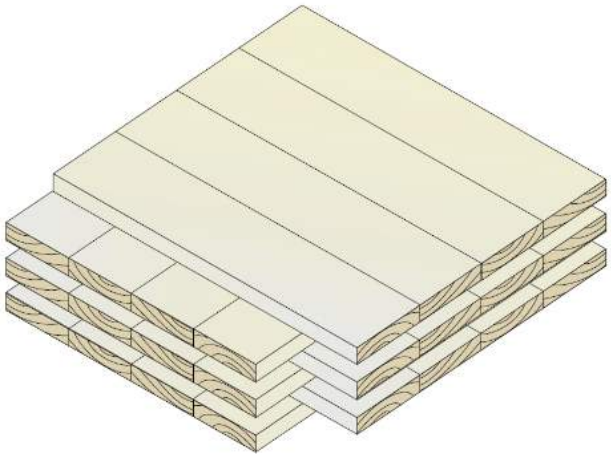
Photo: David Warne & Merk

Cross-laminated timber (CLT)

Photo: David Warne & Merk


Courtesy: KLH & Waugh Thistleton Architects

CLT Production - global



2010
50,000 cubic meters

2015
100,000 cubic meters

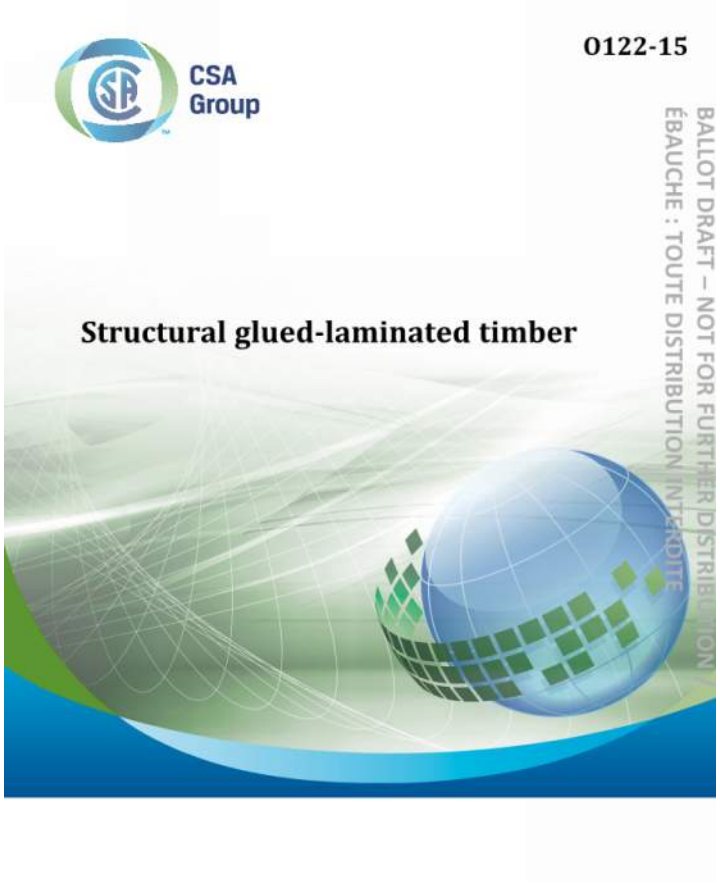
2018
200,000 cubic meters

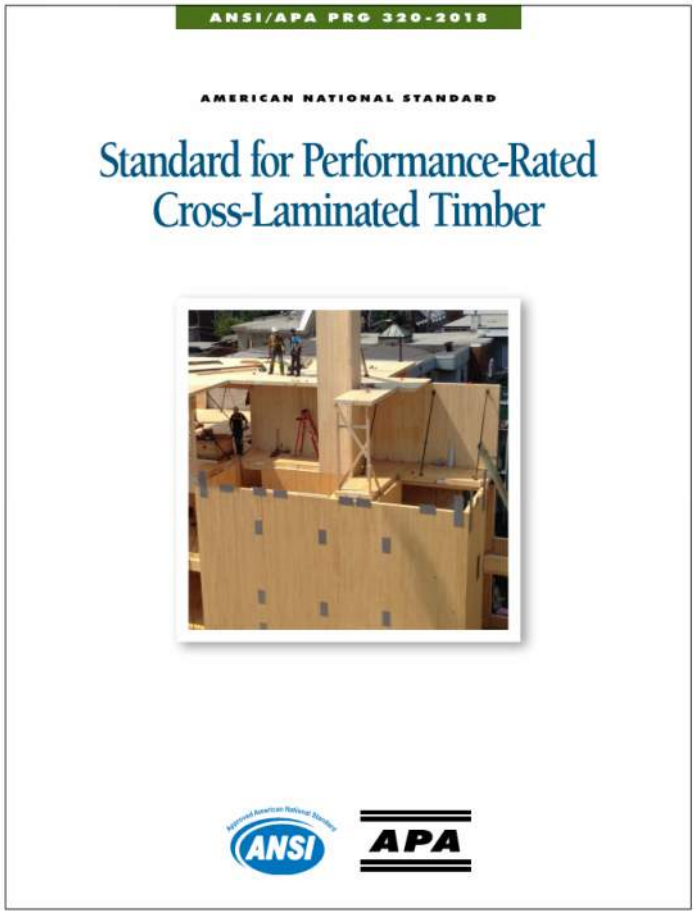
2019-2020
New plants in US and Canada with over 180,000 cubic meters

TIMBERFEVER

moses structural
engineers

Material's Standards





TIMBERFEVER

moses structural engineers

2017

Ontario's Tall Wood Building Reference

A Technical Resource for Developing Alternative Solutions under Ontario's Building Code

October, 2017

Ontario

TIMBERFEVER

moses structural engineers

Fire Scenarios/Design Fires

Fire Scenarios/Design Fires

3-ply, after 2h 5m

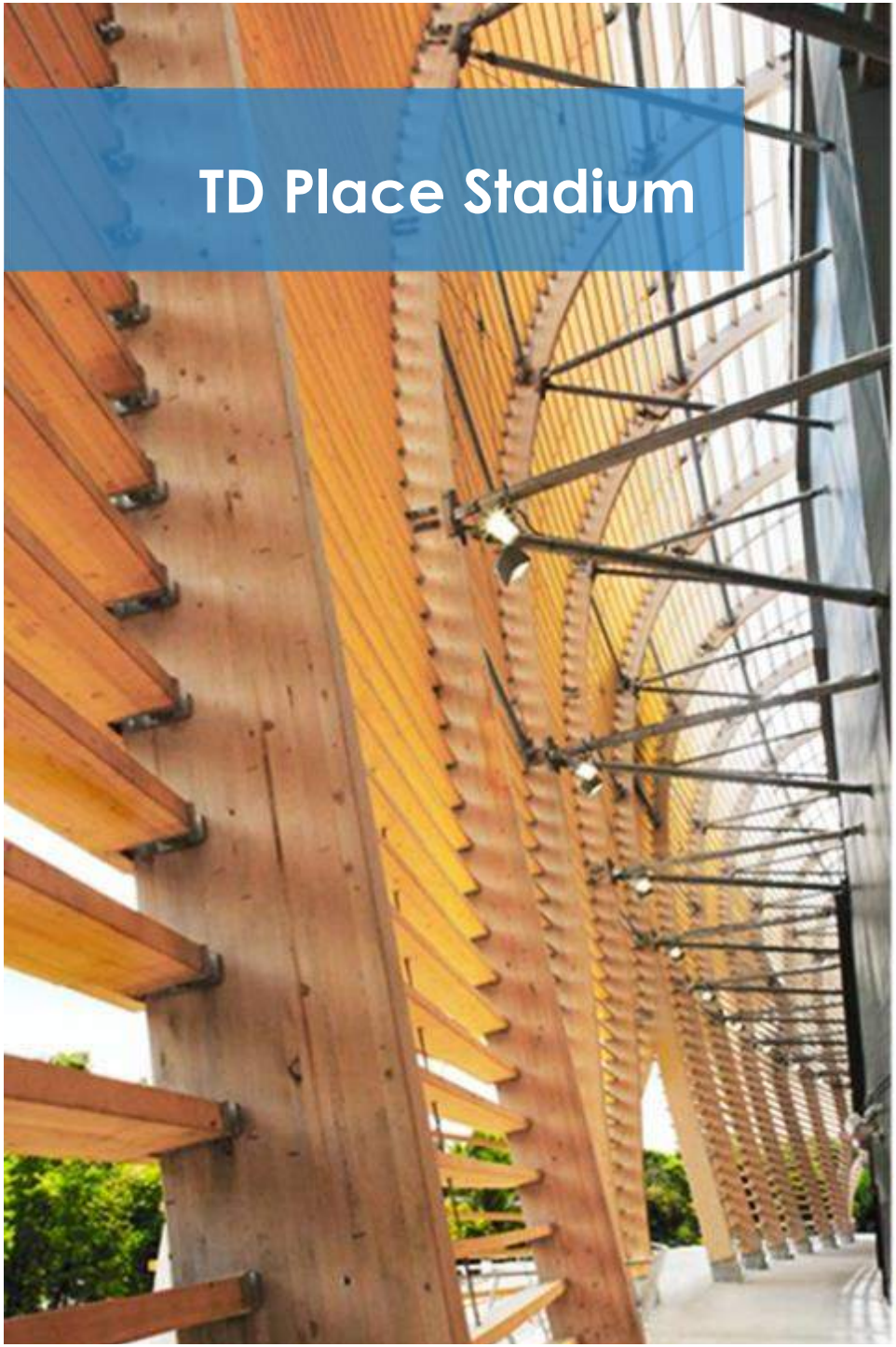
TIMBERFEVER

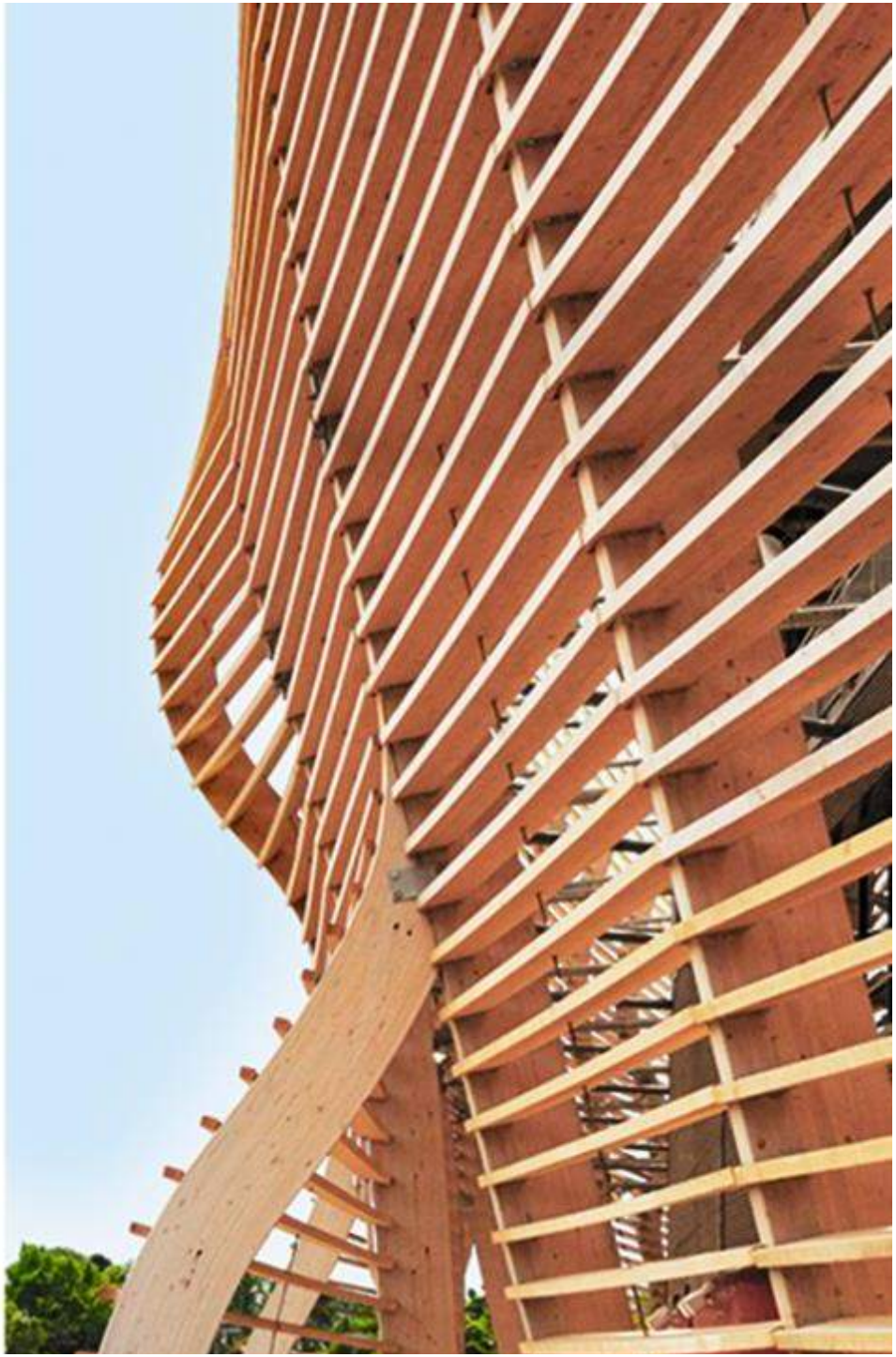
CHM

SECTION 3

Mass Timber Buildings

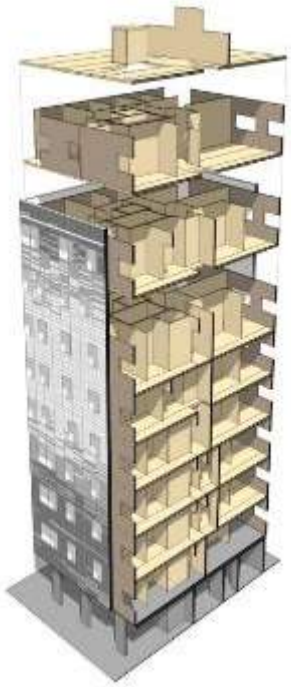
TD Place Stadium





TD Place Stadium

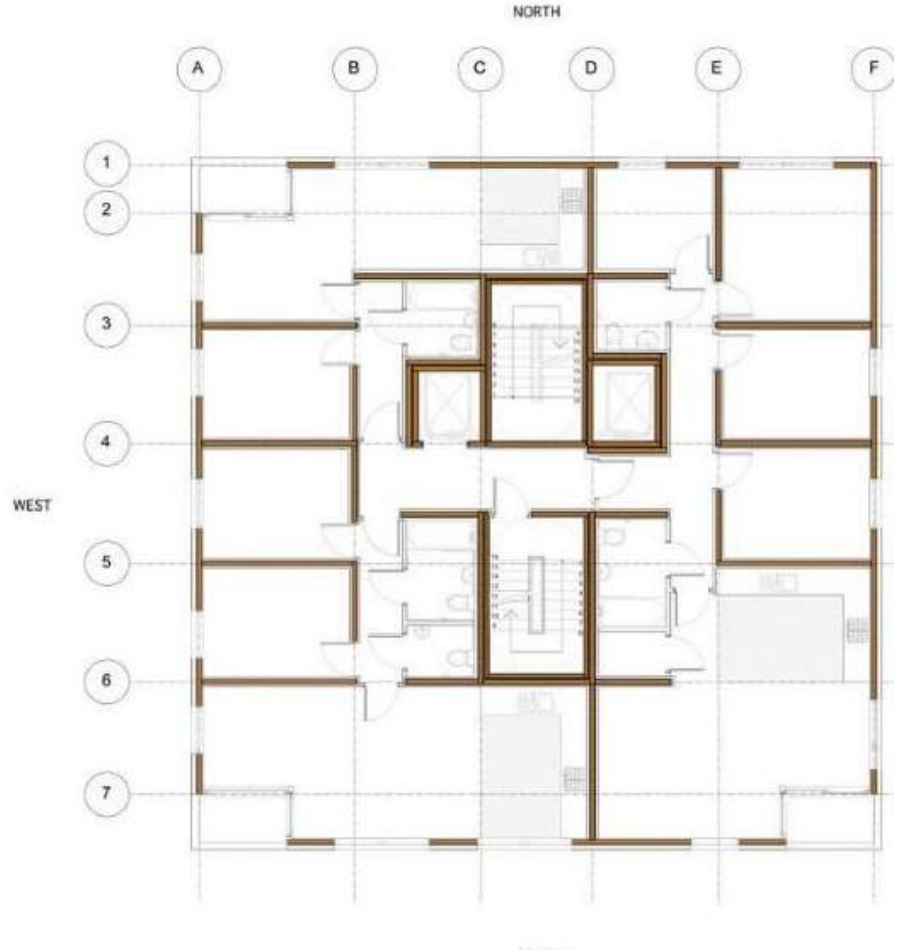
2009: 9-storeys, 9 weeks, London
310 t CO2 offset



- Honeycomb structure
- Rotated plans
- Load-bearing walls, floors and cores
- Tallest timber building in the world

moses structural

Courtesy: Waugh Thistleton Architects



TIMBERFEVER

moses structural

Courtesy: Waugh Thistleton Architects


Courtesy: Waugh Thistleton
Architects


2012 Wayne Gretzky Sports Centre
Brantford, ON – 1st CLT in Ontario


2012 Wayne Gretzky Sports Centre
Brantford, ON – 1st CLT in Ontario

2012 Wayne Gretzky Sports Centre
Brantford, ON – 1st CLT in Ontario

1st CLT Retail - Playvalue Toys
Ottawa, ON


EXIT

2009 MEC Burlington, Ontario

2017 Ottawa – Private Residence

TIMBERFEVER

Courtesy: 555 Design Build

moses structural
engineers

This could have been Toronto's 1st 6-storey mass timber building

ESTIMATED ENVIRONMENTAL IMPACT OF WOOD USE

Volume of wood products used:
2,233 cubic meters of CLT and Glulam

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

Carbon stored in the wood:
1,753 metric tons of CO_2

Avoided greenhouse gas emissions:
679 metric tons of CO_2

Total potential carbon benefit:
2,432 metric tons of CO_2

THE ABOVE GHG EMISSIONS ARE EQUIVALENT TO:

511 cars off the road for a year

Energy to operate a home for **222** years

**Estimated by the Wood Carbon Calculator for Buildings, based on research by Sathre, R. and J. O'Connor, 2010, A Synthesis of Research on Wood Products and Greenhouse Gas Impacts, FPInnovations (this relates to carbon stored and avoided GHG).*

**CO2 in this case study refers to CO2 equivalent*

Table 1. Brock Commons, Vancouver. Source: rethinkWood.com

Origine, 13-storeys
Quebec City

Arbora, Montreal

2012
8-storeys, 8 days! Austria

TIMBERFEVER

moses structural engineers

University of Toronto

Architect: MJMA & Patkau Architects

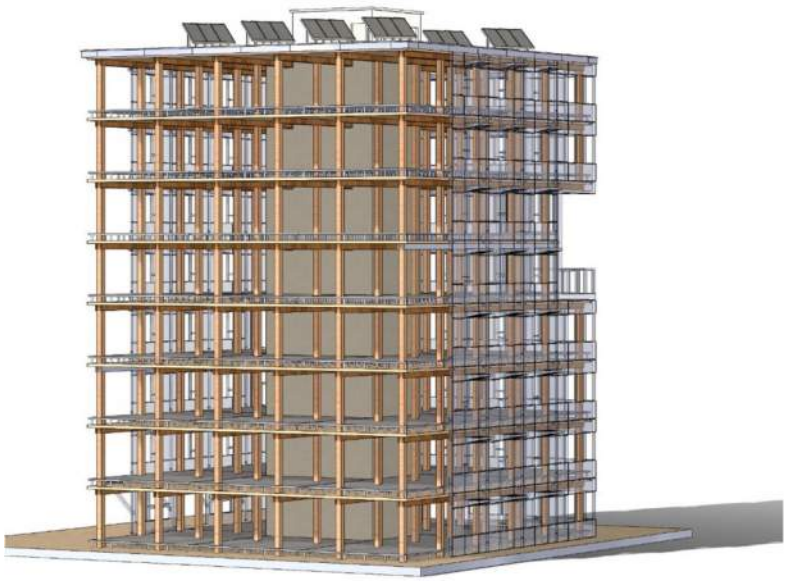
The Arbour, George Brown College, Toronto

Architect: Moriyama and Teshima

SECTION 4

Education & Training

Education & Training



- Engineers, Architects
- Carpenters
- Developers
- Building Owners
- Government (politicians, civil servants, planners, building officials)

TIMBERFEVER

moses structural engineers

TIMMINS
THE DAILY PRESS

Tour of forestry operations in Timmins

Group of architects, engineers and builders from Southern Ontario take in harvesting operations and tour Timmins sawmill.

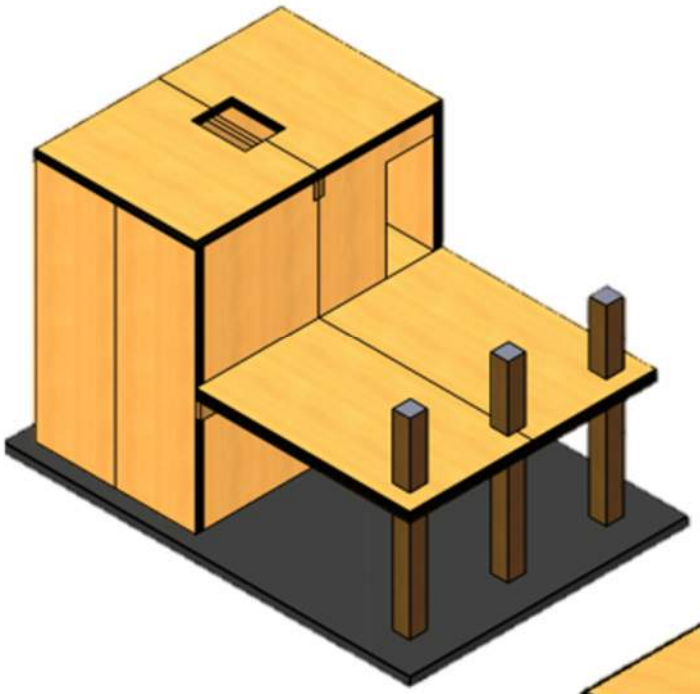
Ron Grech
More from Ron Grech (https://www.timminspress.com/author/rgrech)

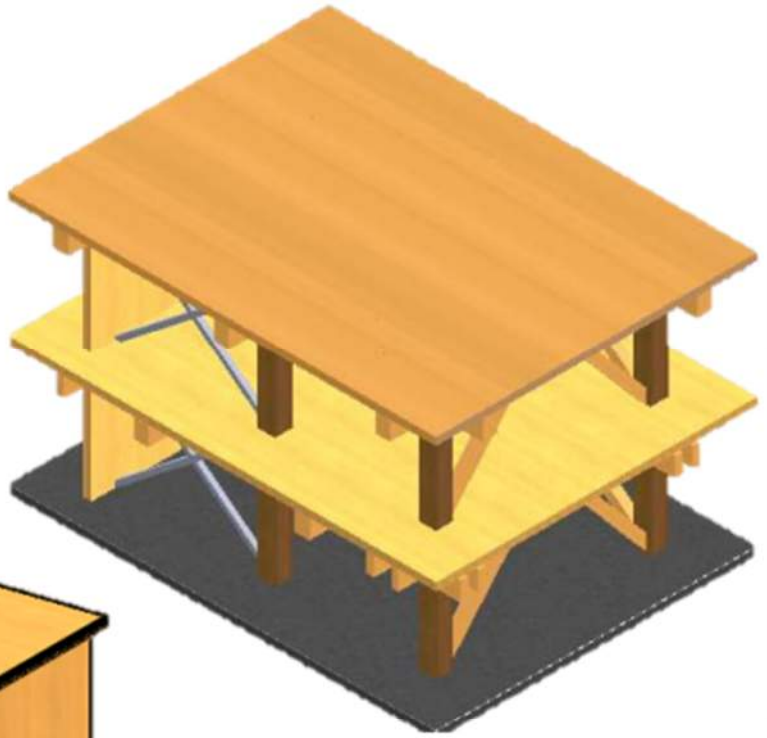
Published on: August 16, 2019 | Last Updated: August 16, 2019 7:33 PM EDT

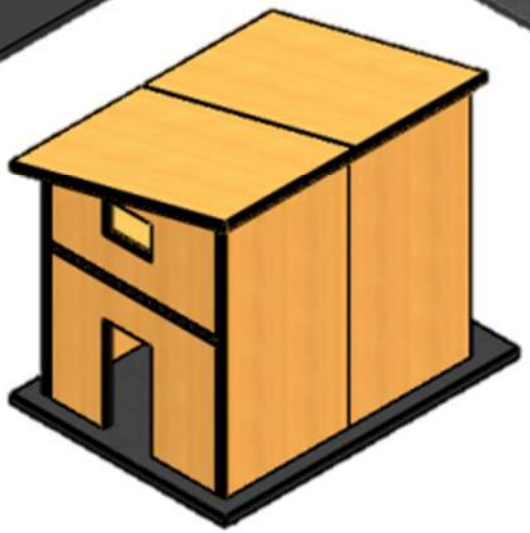
Joël Cantin, interim manager of the Timmins EACOM sawmill, led a tour of architects, engineers, and union leaders through the mill Thursday. Also seen addressing the group here before heading into the mill is Christine Leduc, director of public affairs for EACOM Timber Corporation. RON GRECH/THE DAILY PRESS JPG, TD

moses structural
engineers

2018 Mass Timber Training







TIMBERFEVER

moses structural engineers

Moses Structural Engineers presents 5th Annual TimberFever

TimberFever Design-Build Competition connects students with wood and creativity

Ontario Construction News staff writer

The results are in from the #TimberFever Design-Build Competition last weekend at Ryerson University.

The competition, in its fifth year, is based on students conceiving and building wood structures in an intense weekend of teamwork and competition.

They received a "surprise brief" at the start – and had the task of building an Urban Parklet out of wood.

Organizers say a mix of students from architecture and civil engineering programs were placed in 16 teams with limited building supplies, where they collaborated on design and construction.

Industry leaders volunteered their time to monitor the teams and judge the completed parklets. Carpenters Union (Local 27) provided hands-on support during construction.

"We're working hard to make this a national competition," said David Moses at the TimberFever Awards Ceremony on Sunday. "TimberFever's five-year anniversary was a tremendous success with architecture and civil engineering students from universities across Canada, including Ryerson, U of T, UNB, McGill and more."

Moses is the event's founder and principal of Moses Structural Engineers.

"Since the beginning, we've felt a real sense of community around TimberFever, where everyone comes together to collaborate, teach and inspire. It's been wonderful to watch and we're so thankful to everyone involved."

While judges selected winners after the weekend competition, the decision on the People's Choice Award is still open, and available for online voting. You can access the project images and briefs here.

Daily Commercial News
by ConstructConnect

TimberFever 2019 gets students collaborating

Don Procter September 23, 2019

DON PROCTER — Participants take part in the design-build competition at TimberFever 2019 held at Ryerson University in downtown Toronto.

TIMBERFEVER

moses structural engineers

Conclusion

Summary

1. Major shift in how we conceive buildings
2. Not much standardization…yet
3. Education required for developers, institutional decision-makers, building officials

TIMBERFEVER

moses structural engineers


@mosesstructures
www.mosesstructures.com