BROCK COMMONS
TALLWOOD HOUSE

MODULE
2017 | 03

PROJECT OVERVIEW

BROCK COMMONS

BACKGROUND

MASS TIMBER BUILDINGS

PROJECT CONTEXT

(Title page image: naturally:wood)

HISTORICAL TALL WOOD BUILDINGS

Yingxian Pagoda | 67 metres | 1056
Shanxi, China
(Image: Gisling)

Urnes Stavkirke | 1130
Sogn og Fjordane, Norway
(Image: Unesco)

Barsana Monastery | 56 metres | 1720
Transylvania, Romania
(Image: Green)

TALL WOOD BUILDINGS IN 19th CENTURY - CANADA

The Landing | 8 storeys
Vancouver, Canada

(Images: Angelique Pilon)

CONTEMPORARY TALL WOOD BUILDINGS

★ *Completed in past 5 years*

★ *Planned/Under Construction*

T3 | 7 storeys
Minnesota, United States
(Image: MG Architecture)

Cenni di Cambiamento | 9 storeys
Milan, Italy
(Image: Riccardo Ronchi)

- 17 Tall Wood Buildings (7+ storeys) were built in the past 5 years
- 9 are planned or under construction (incl. Brock Commons)
- Regulators play an important role in encouraging TWB projects:
  - Aligned sustainability incentives
  - Streamlined approval process
  - Early engagement with the project team

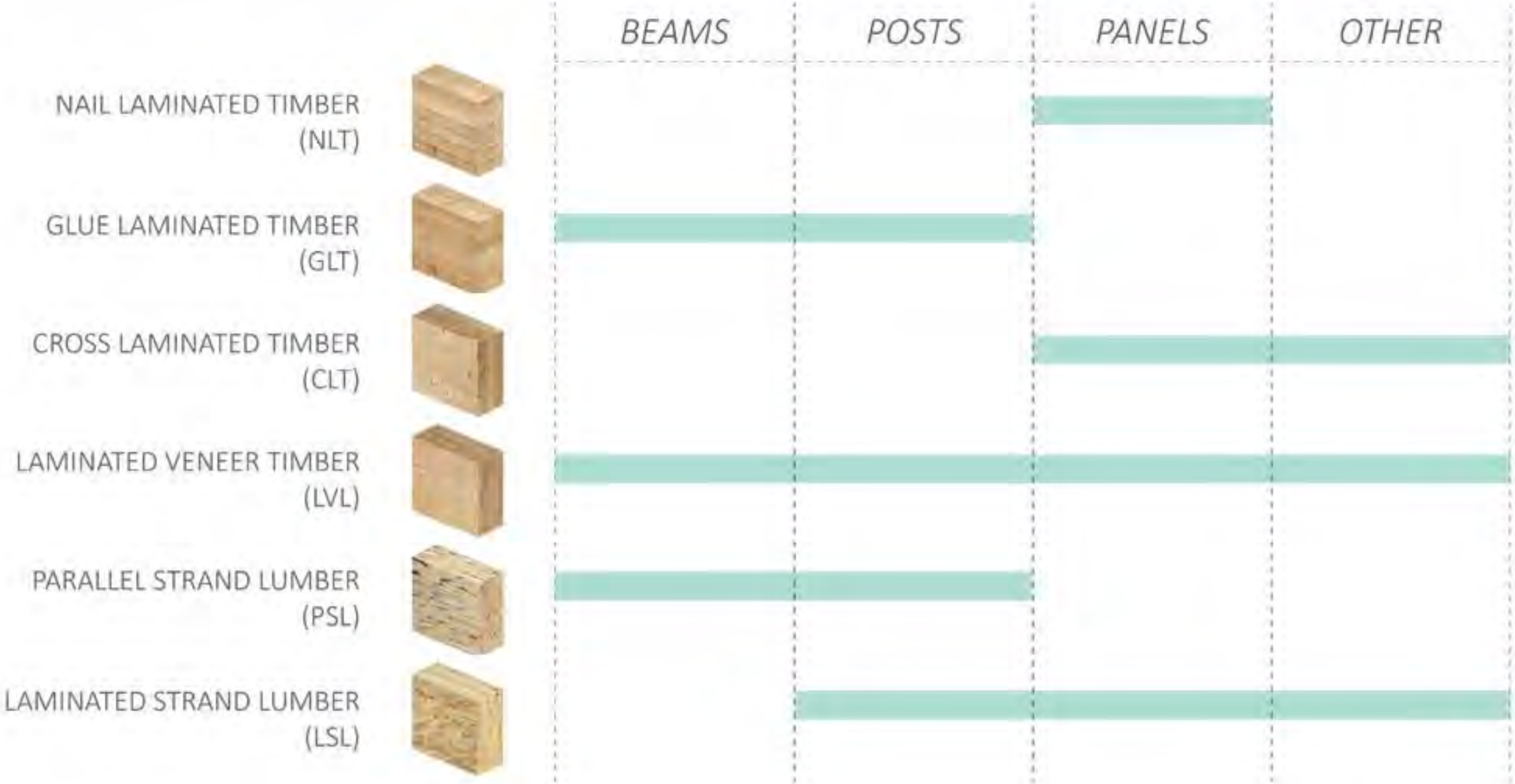
CONTEMPORARY TALL WOOD BUILDINGS - CANADA

UBC Earth Sciences Building | 6 storeys
Vancouver, Canada
(Image: Martin Tessler and Don Erhardt)

Wood Innovation & Design Centre | 6 storeys
Prince George, Canada
(Images: Ema Peter and Ed White)

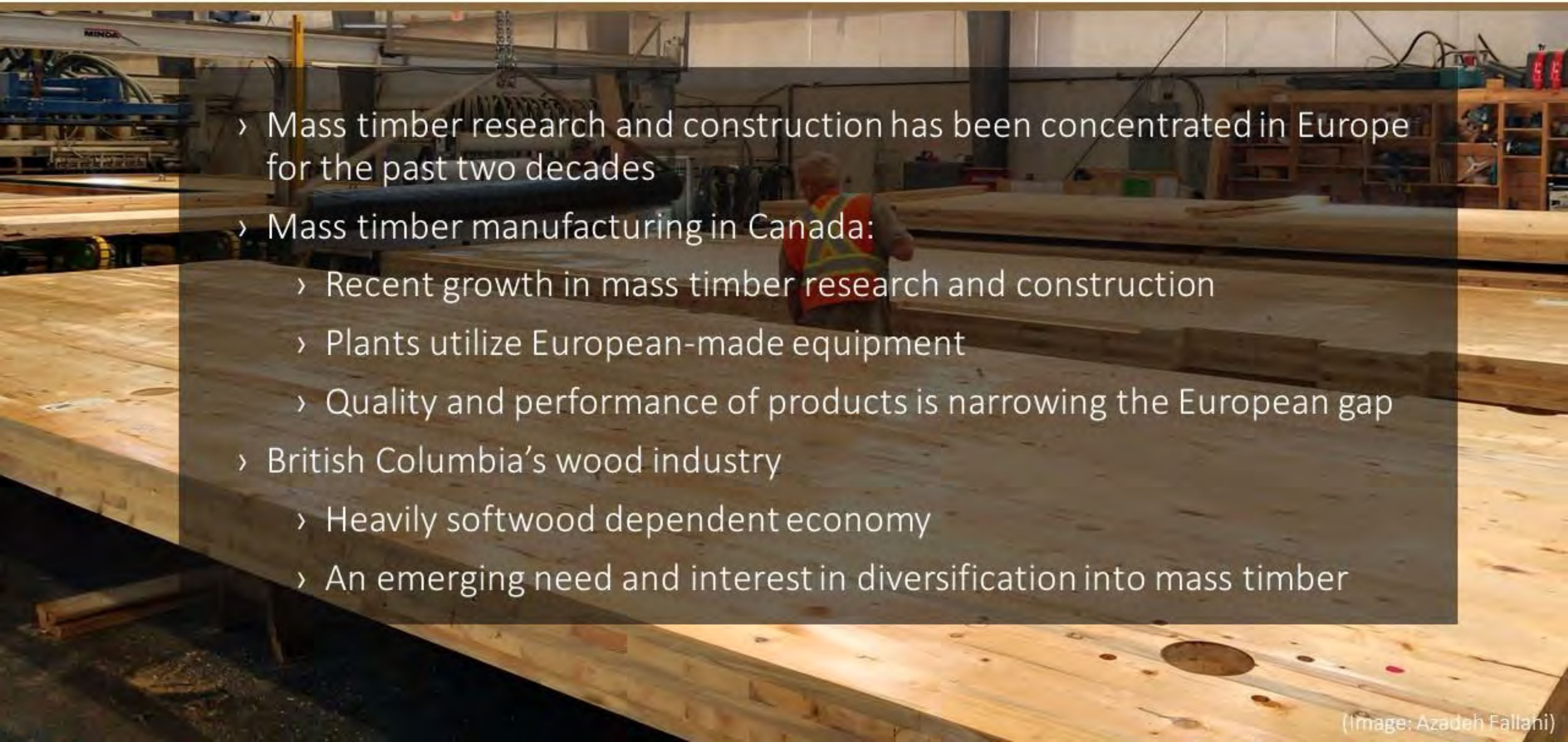
Origine | 13 storeys
Quebec, Canada
(Image: Yvan Blouin Architecte)

MASS TIMBER OVERVIEW



(Table: Salah Koleilet & Laura Gilmore)

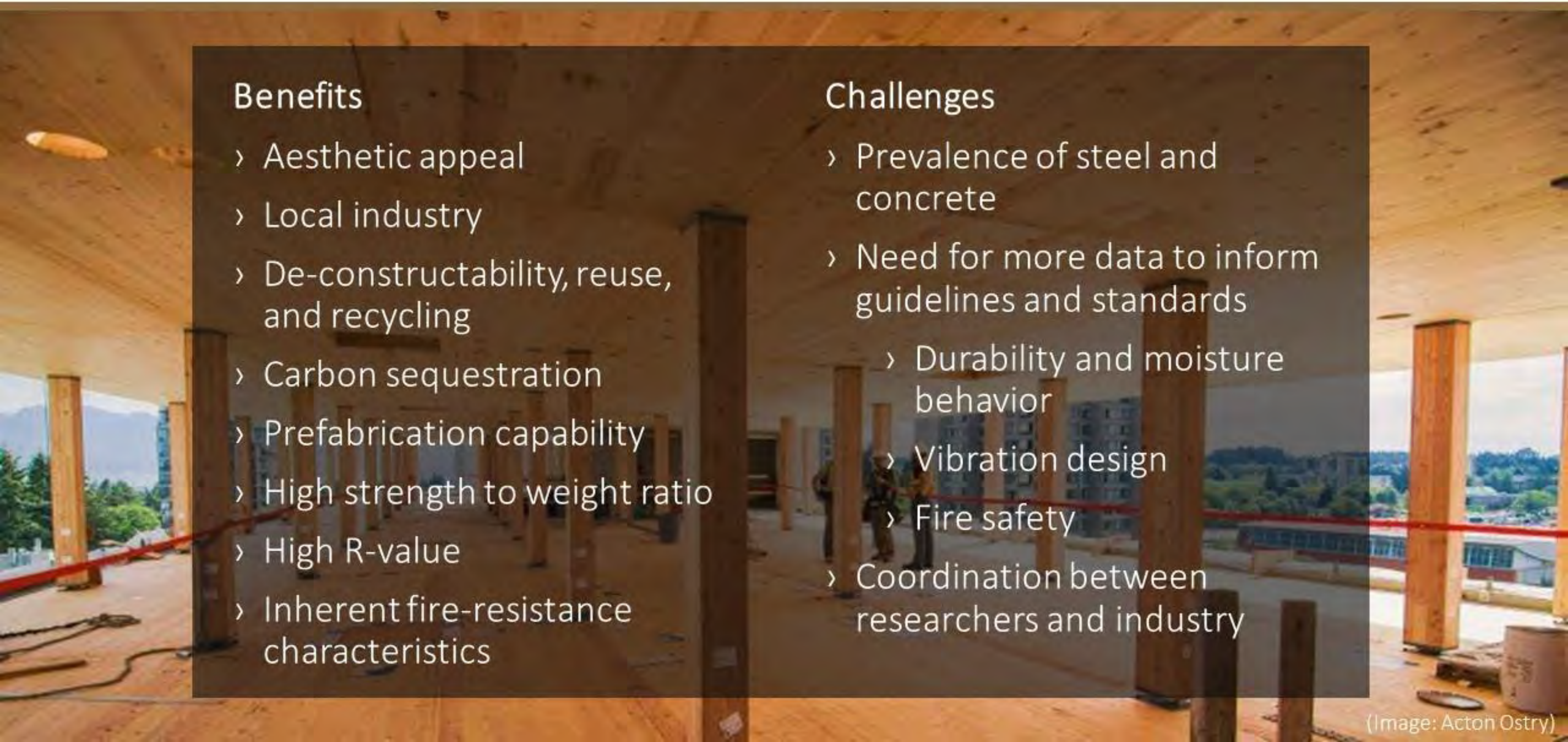
MASS TIMBER IN B.C. & CANADA



- Mass timber research and construction has been concentrated in Europe for the past two decades
- Mass timber manufacturing in Canada:
  - Recent growth in mass timber research and construction
  - Plants utilize European-made equipment
  - Quality and performance of products is narrowing the European gap
- British Columbia's wood industry
  - Heavily softwood dependent economy
  - An emerging need and interest in diversification into mass timber

(Image: Azadeh Fallahi)

MASS TIMBER BENEFITS & CHALLENGES



Benefits

- Aesthetic appeal
- Local industry
- De-constructability, reuse, and recycling
- Carbon sequestration
- Prefabrication capability
- High strength to weight ratio
- High R-value
- Inherent fire-resistance characteristics

Challenges

- Prevalence of steel and concrete
- Need for more data to inform guidelines and standards
  - Durability and moisture behavior
  - Vibration design
  - Fire safety
- Coordination between researchers and industry

(Image: Acton Ostry)

CURRENT CONSTRUCTION PRACTICES IN BC

Typical British Columbia High-Rise
cast-in-place reinforced concrete
(Image: farweststeel.com)

Typical British Columbia Mid-rise
"stick-built" or wood-framed construction
(Image: Canadian Wood Council)

TALL WOOD BUILDING DEMONSTRATION INITIATIVE

(Image: Zahra Teshnizi)

Natural Resources Canada (NRCan) and Canadian Wood Council (CWC) Joint initiative:

- Encourage use of mass timber in high-rise buildings
- Link scientific advances with technical expertise
- Foster growth in wood construction and forestry industries

Brock Commons was selected as one of the demonstration projects in 2013

UBC INNOVATION & SUSTAINABILITY MANDATE

- Meet the need for student housing
- Create opportunities for research and education
- Advance sustainability practices and policies
- Use the campus as a 'Living Lab' for demonstration projects

(Image: Campus Planning, Russ Heinl)

BROCK COMMONS

DESIGN & PRE-CONSTRUCTION

- PROJECT OVERVIEW
- SITE SPECIFIC REGULATION
- DESIGN TEAM
- DESIGN PROCESS

TALLWOOD HOUSE OVERVIEW

Site area: 2,315 m^2
Building Footprint: 840 m^2 (15m x 56m)

- 18 storeys (17 storeys wood)
- 53 metres high
  - Maximum allowable height UBC Campus Plan
- 2.81 m floor to floor height (5 m on ground floor)

(Image: Acton Ostry)

FLOOR LAYOUT

Ground floor

- Food services
- Amenities
- Service rooms

Upper levels

- 404 residence beds
  - 272 studios (25.5 m² each)
  - 33 four-bed units (112.5 m² each)

Ground Floor Plan

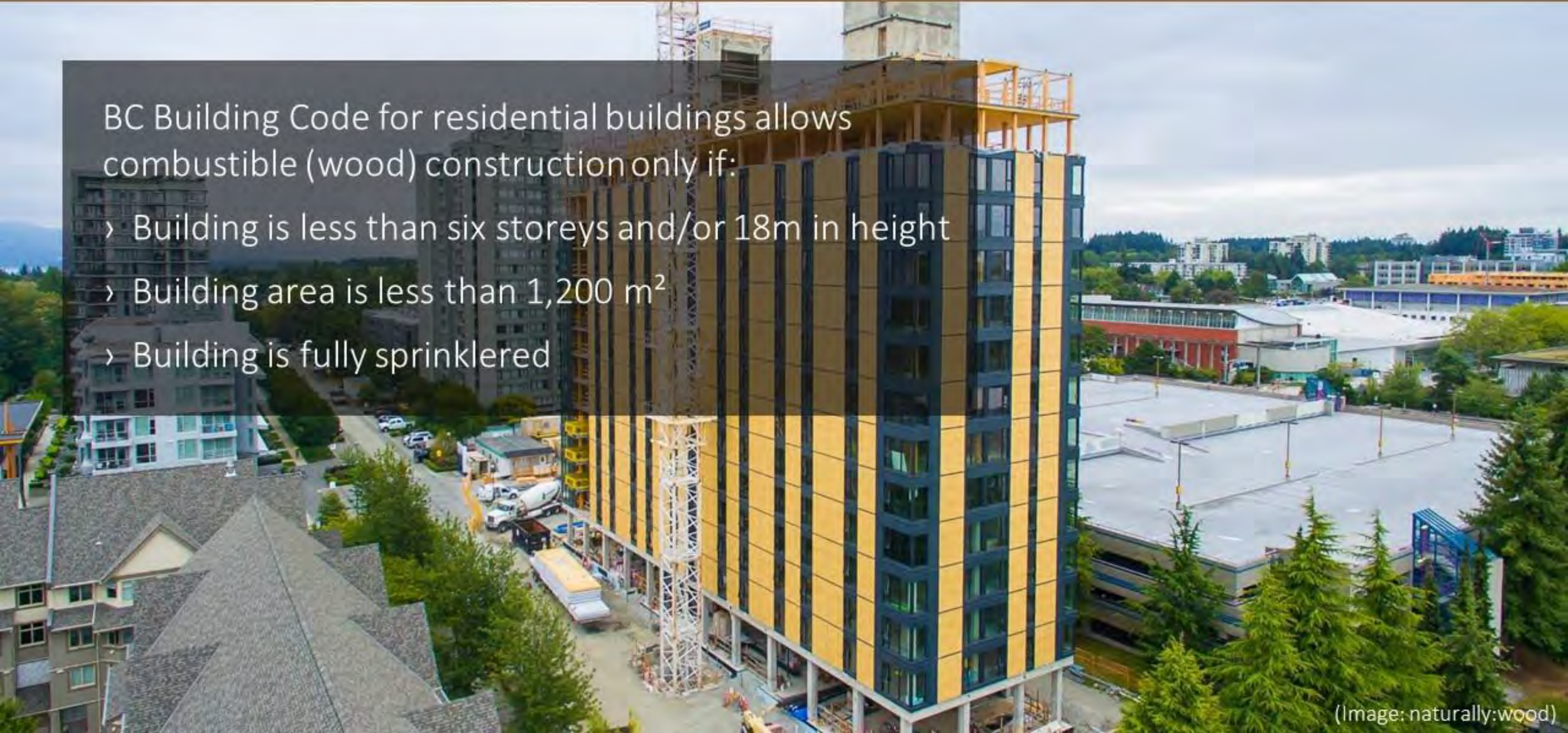
Typical Floor Plan

(Images: Acton Ostry)

REGULATORY CONTEXT

BC Building Code for residential buildings allows combustible (wood) construction only if:

- Building is less than six storeys and/or 18m in height
- Building area is less than 1,200 m²
- Building is fully sprinklered



(Image: naturally:wood)

SITE SPECIFIC REGULATION (SSR)

UBC Tall Wood Building Regulation

- Provincial code regulation issued by BC's Building Standards and Safety Branch
- Exempts the project from the size limitations on wood construction and includes strict technical performance requirements
- Ensures occupants' health and safety protection equal or better than a non-combustible building of the same size
- Entailed a comprehensive peer and expert review process
- Does not set a legal precedent for future projects

(Image: naturally:wood)

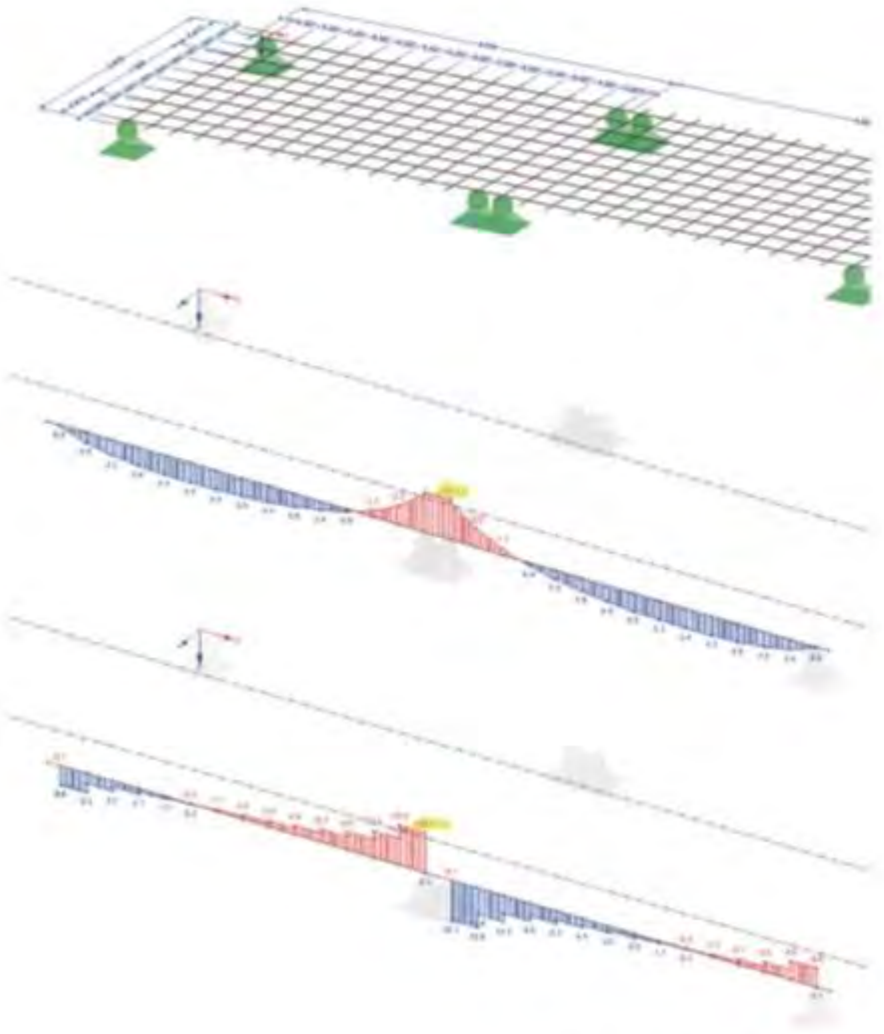
SSR PEER AND PANEL REVIEWS

Structural Engineering peer reviewers

- A local firm expert in local code requirements reviewed structure as a whole
- An international firm expert in mass timber structures reviewed mass timber components (structural performance and fire design safety)

Structural and Fire Safety review panels

- Provided guidance and feedback regarding specific design strategies and decisions
- Included architects, engineers, fire and code officials, research organizations and University faculty



Panel structural analysis
(Image: merz kley partner AG)

SSR MAIN REQUIREMENTS

The UBC Brock Commons Regulation meets or exceeds the level of performance required by the BC Building Code 2012

Other SSR requirements

- 18 storeys max. with defined uses
- Concrete cores and 1st floor
- Exposed wood structure only on L18 lounge and L1 canopy
- Mechanical smoke control system
- Structural system designed to NBC[1] 2015 seismic activity standards

Code requirements and proposed solutions

BC Building Code 2012	Brock Commons Regulation	Level of Performance
Non-combustible construction	Encapsulated mass timber	Equivalent
Sprinklered building	Sprinklered building with on-site backup water supply	Exceeds
2h fire rating floors and supports	2h fire rating floors, supports, suite/suite partitions and exit stairs	Equivalent or exceeds

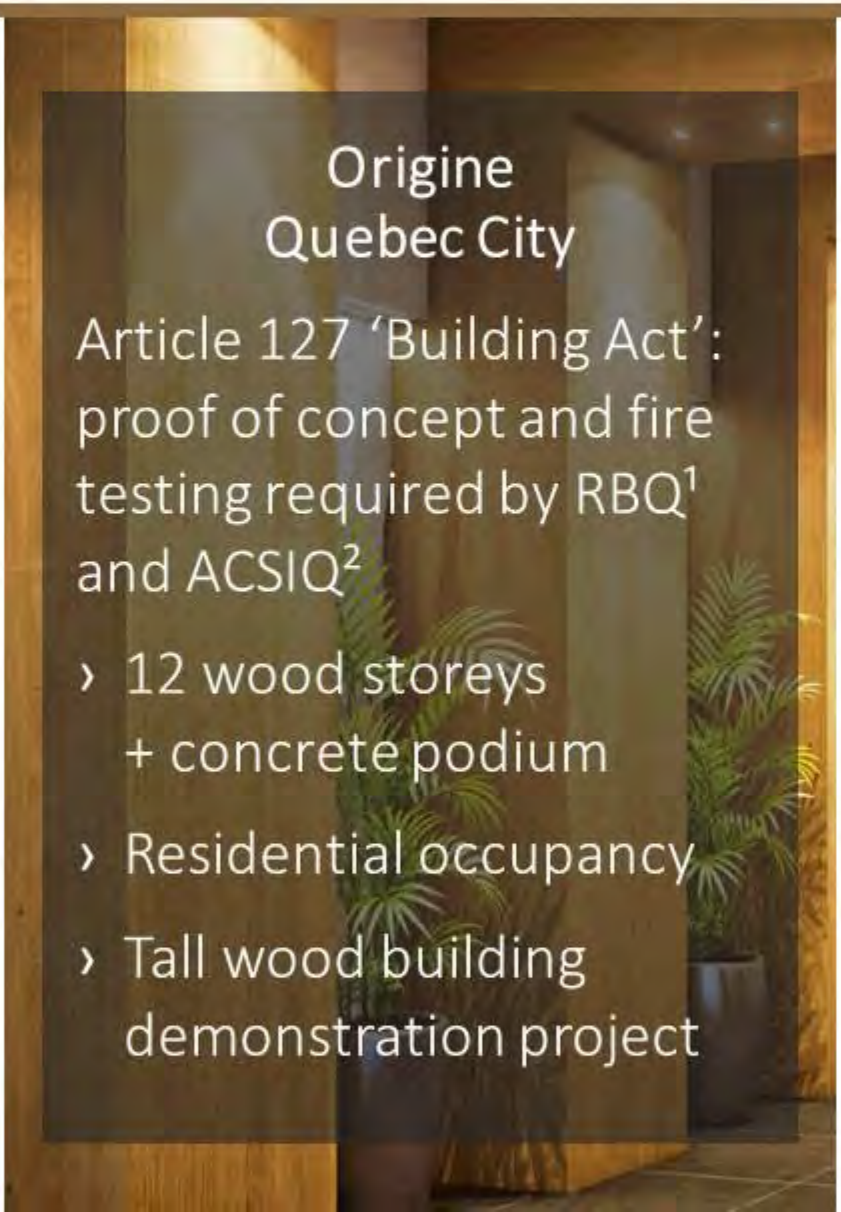
(Table: GHL Consultants & Diana Lopez)

REGULATIONS FOR TALL WOOD BLDGS. IN CANADA

WIDC
Prince George

Site Specific Regulation

- 6 wood storeys
  + GF mezzanine
  + mech. penthouse
- Assembly and office occupancy
- BCBC 2012 – 4 storeys limit for wooden non-residential buildings



Origine
Quebec City

Article 127 'Building Act': proof of concept and fire testing required by RBQ[1] and ACSIQ[2]

- 12 wood storeys
  + concrete podium
- Residential occupancy
- Tall wood building demonstration project

Arbora
Montreal

'Mass timber buildings of up to 12 storeys' directives (Article 127 'Building Act')

- 3 buildings:
  7 wood storeys
  + concrete podium
- Residential occupancy
- CLT & GLT components

(Images: MG Architecture & Nordic Structures)

REGULATION REQUIREMENT COMPARISON

	STOREYS + USE	CONCRETE	ENCAPSULATION	FIRE SAFETY	SPRINKLERES	FIRE TESTS
UBC TALL WOOD BUILDING REGULATION *Brock Commons Tallwood House*	*18 storeys (17 + 1) group A2 + C*	*foundation, cores & first floor*	*all elements*	*fire resistant partitions & exit stairs*	*sprinklered throughout*	*CLT fire stopping*
WOOD INNOVATION DESIGN CENTRE REGULAITON *WIDC*	*6 storeys group A2 + D*	*foundation*	*not required*	*fire resistant exterior walls*	*sprinklered throughout*	*penetrations & joints*
ORIGINE CONSTRUCTION PERMITS *Origine*	*13 storeys (12+1) group C*	*foundation & first floor*	*all structural elements*	*2 hour fire resistant rating*	*sprinklered throughout*	*structure fire performance*
QUEBEC MASS TIMBER DIRECTIVES *Arbora*	*7-12 storeys (12+1) group C or D*	*foundation & first floor*	*all structural elements*	*1-2 hour fire resistant ratings*	*sprinklered throughout*	*not required*

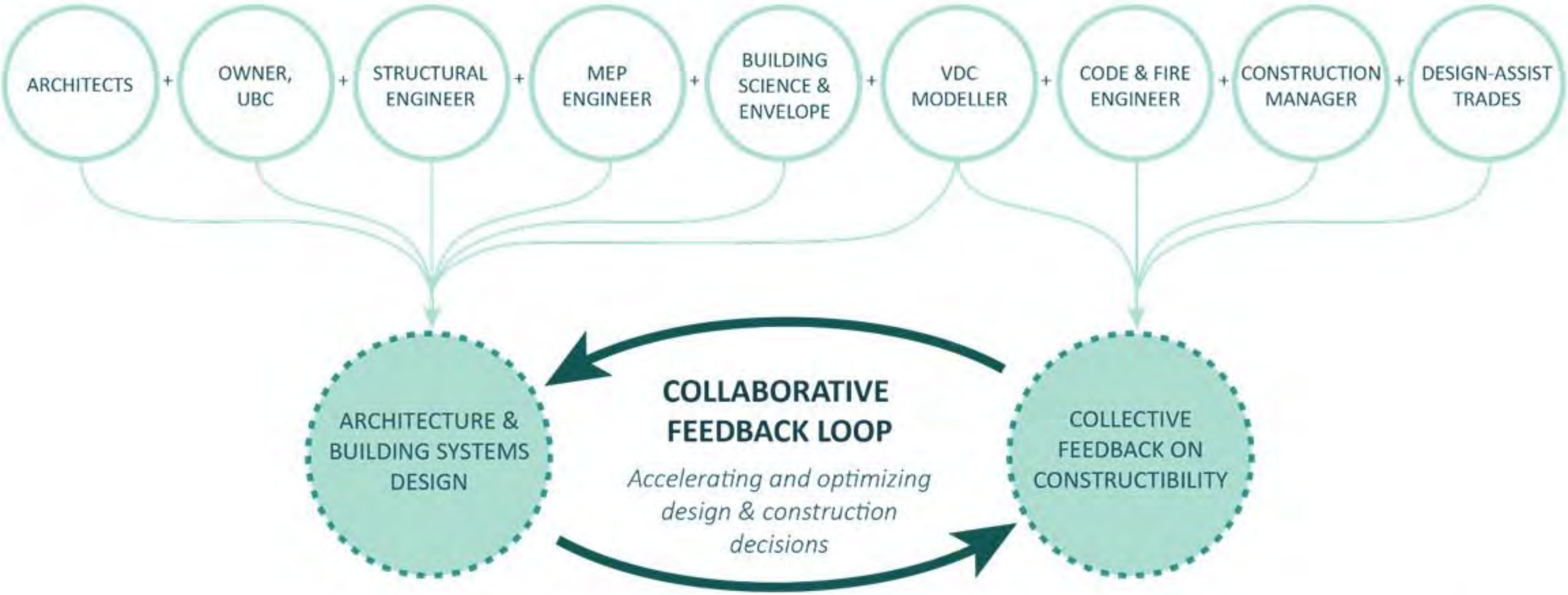
(Table: Diana Lopez & Laura Gilmore)

COLLABORATIVE DISCIPLINES

- ARCHITECT — *Acton Ostry Architects Inc.*
- ADVISORY ARCHITECT — *Architekten Herman Kaufmann ZT GmbH*
- MEP ENGINEER — *Stantec*
- STRUCTURAL ENGINEER — *Fast + Epp*
- CODE & FIRE ENGINEER — *GHL Consultants Ltd.*
- BUILDING SCIENCE & ENVELOPE — *RDH Building Science Inc.*
- MASS TIMBER SUPPLIER — *Structurlam Products LP*
- DESIGN-ASSIST TRADES — *Seagate Structures, Whitewater Concrete Ltd., Trotter & Morton*
- OWNER, UBC — *UBC Infrastructure Development*
- PROJECT MANAGER — *UBC Properties Trust*
- CONSTRUCTION MANAGER — *Urban One Builders*
- VIRTUAL MODELLING — *CadMakers Inc.*

(Image: Acton Ostry)

COLLABORATIVE FEEDBACK LOOP



(Image: Laura Gilmore)

DESIGN RATIONALE & STRATEGY

Design Philosophy:

"Tall wood in not about promoting a vision, but rather fueling an evolution"- Hermann Kaufmann

Design Objective:

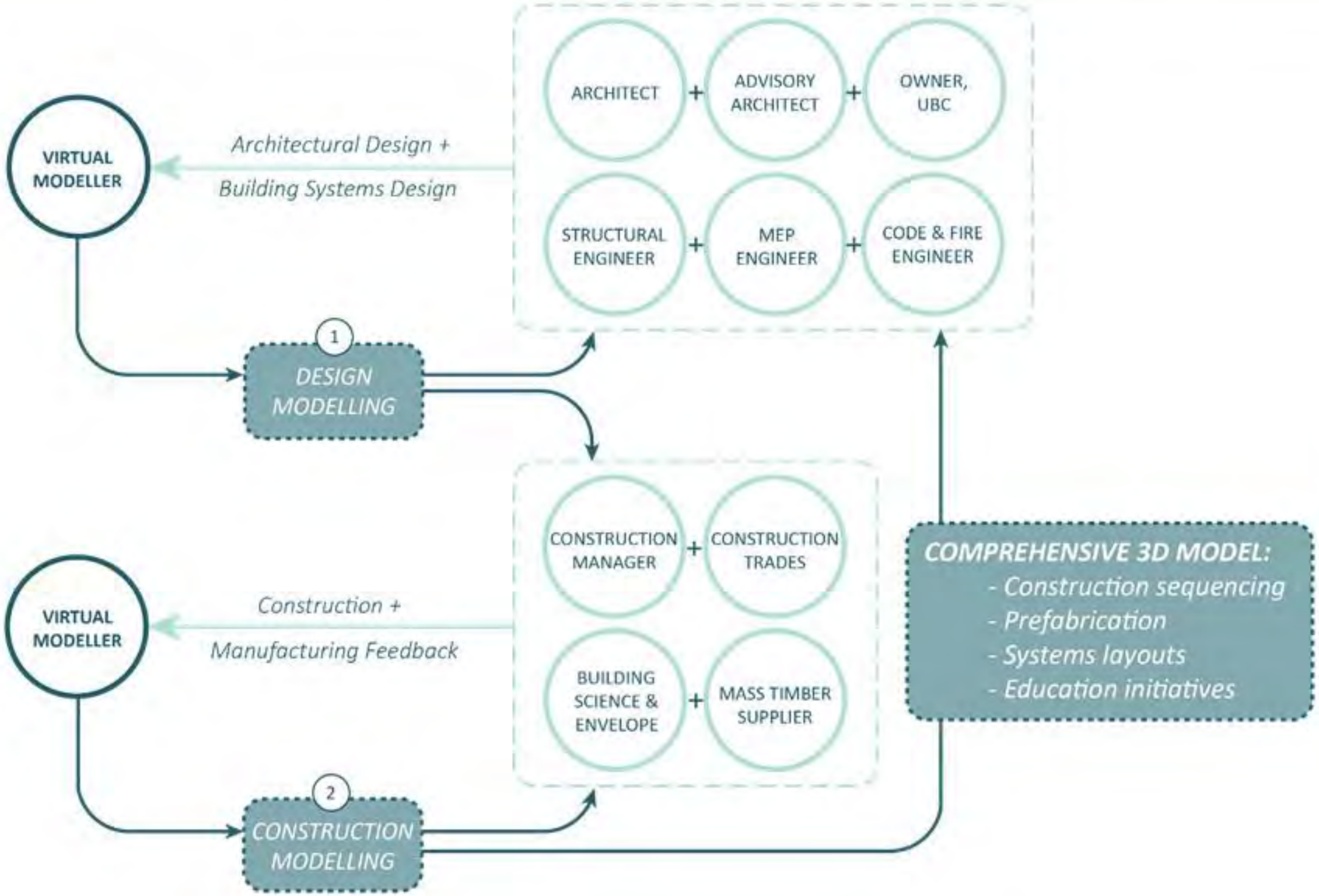
To serve as a replicable model for future tall wood construction

Design Strategy:

"Keep it simple" – Acton Ostry

(Image: Acton Ostry)

ADDED VALUE OF VIRTUAL DESIGN & CONSTRUCTION



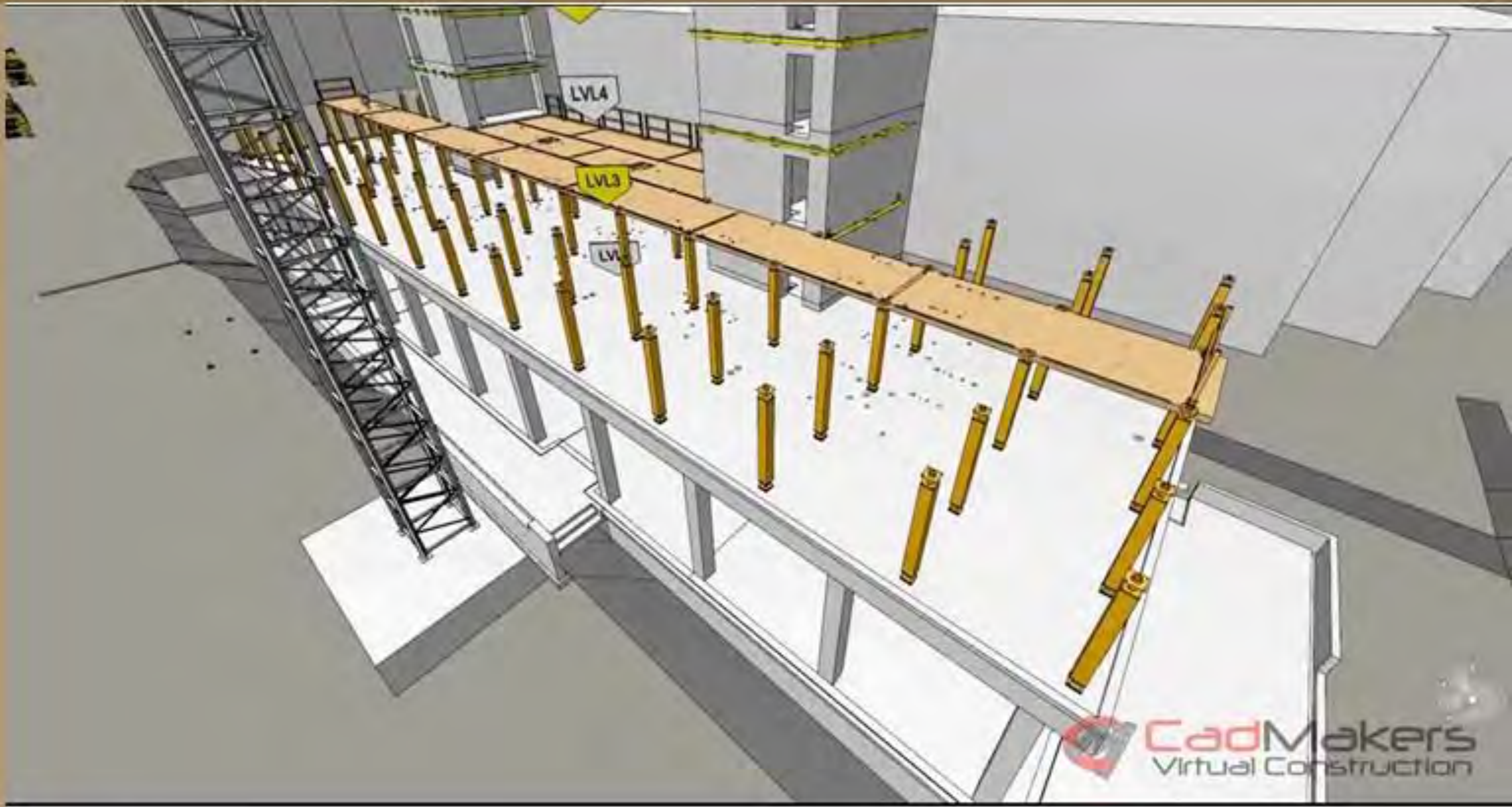
(Image: Laura Gilmore)

VDC MODEL IN DESIGN PROCESS

DESIGN & PLANNING

Single comprehensive 3D model developed and maintained by VDC modellers

- Design-assist tool
  - Design decision-making
  - Building systems coordination
  - Clash detection
  - Quantity takeoffs for cost estimations
- Constructability review
  - Building processes
  - Site Safety

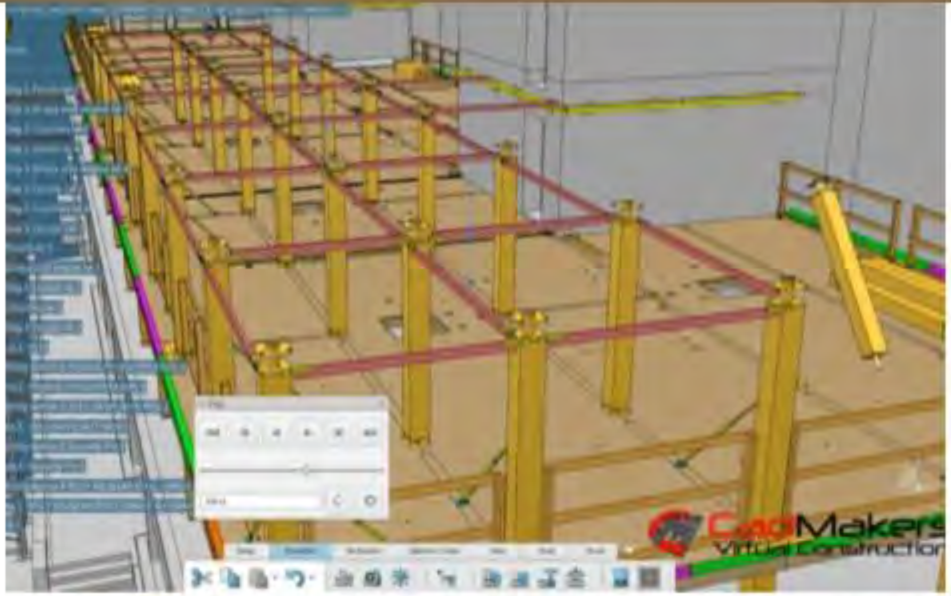


(Video: CadMakers Inc.)

VDC MODEL IN CONSTRUCTION PROCESS

CONSTRUCTION

- Construction assist tool
  - Trades communication
  - Team cooperation
  - Construction planning and sequencing
- Fabrication model
  - Direct output to the mass-timber fabricator
  - Predesigned layouts of all MEP systems for CLT penetrations and cut-outs



(Images: CadMakers Inc. & naturally:wood)

BROCK COMMONS

THE BUILDING

HYBRID STRUCTURE

PREFABRICATION

CONSTRUCTION PROCESS

MEP SYSTEMS

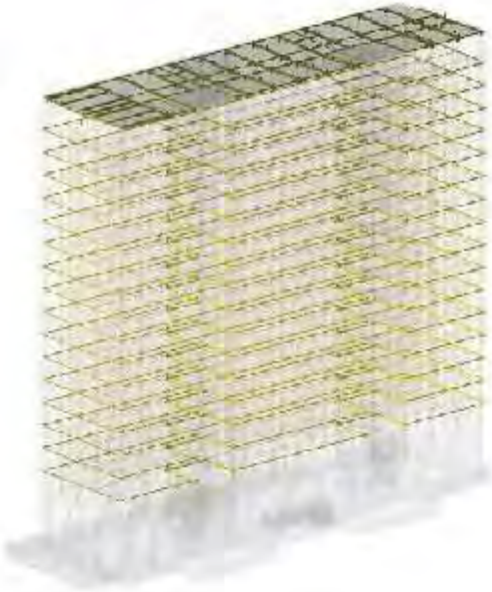
A HYBRID STRUCTURE

Cast-In-Place Reinforced Concrete Structure

- Foundation
- Ground Floor
- Second floor slab
- Building floors

Wood Structure Components

- CLT panels for floors
- GLT columns
- PSL heavy-loaded columns



Steel Components

- Connections
- Floor perimeters
- Roof decking + structure

(Images: CadMakers Inc.)

MASS TIMBER PRODUCTS

Cross Laminated Timber
Used for floor slabs

Glue Laminated Timber
Used for structural columns

Parallel Strand Lumber
Used for heavy-loaded structural columns

(Images: Laura Gilmore, Erik Poirier, Uyen Tran)

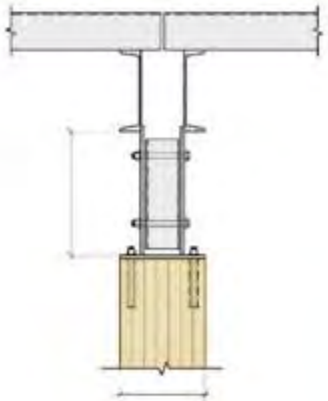
GRAVITY LOAD DESIGN

- The mass-timber structure is supported by the concrete second floor transfer slab, first floor columns and foundation
- Floor 3-18 structure consists mass timber 2-way floor slabs and columns, carried by point loads at the column connections

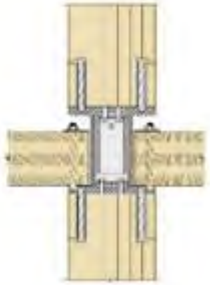
(Image: Fast + Epp)

VERTICAL CONNECTIONS

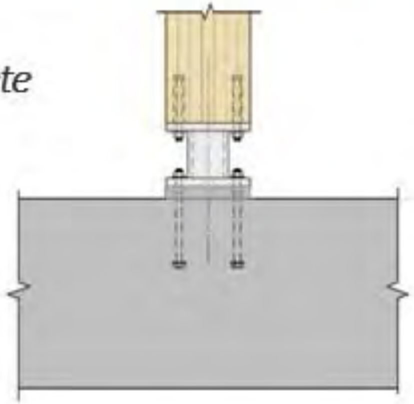
Columns to Steel
Roof Connection



Columns to Wood
CLT Connection



Columns to Concrete
Slab Connection



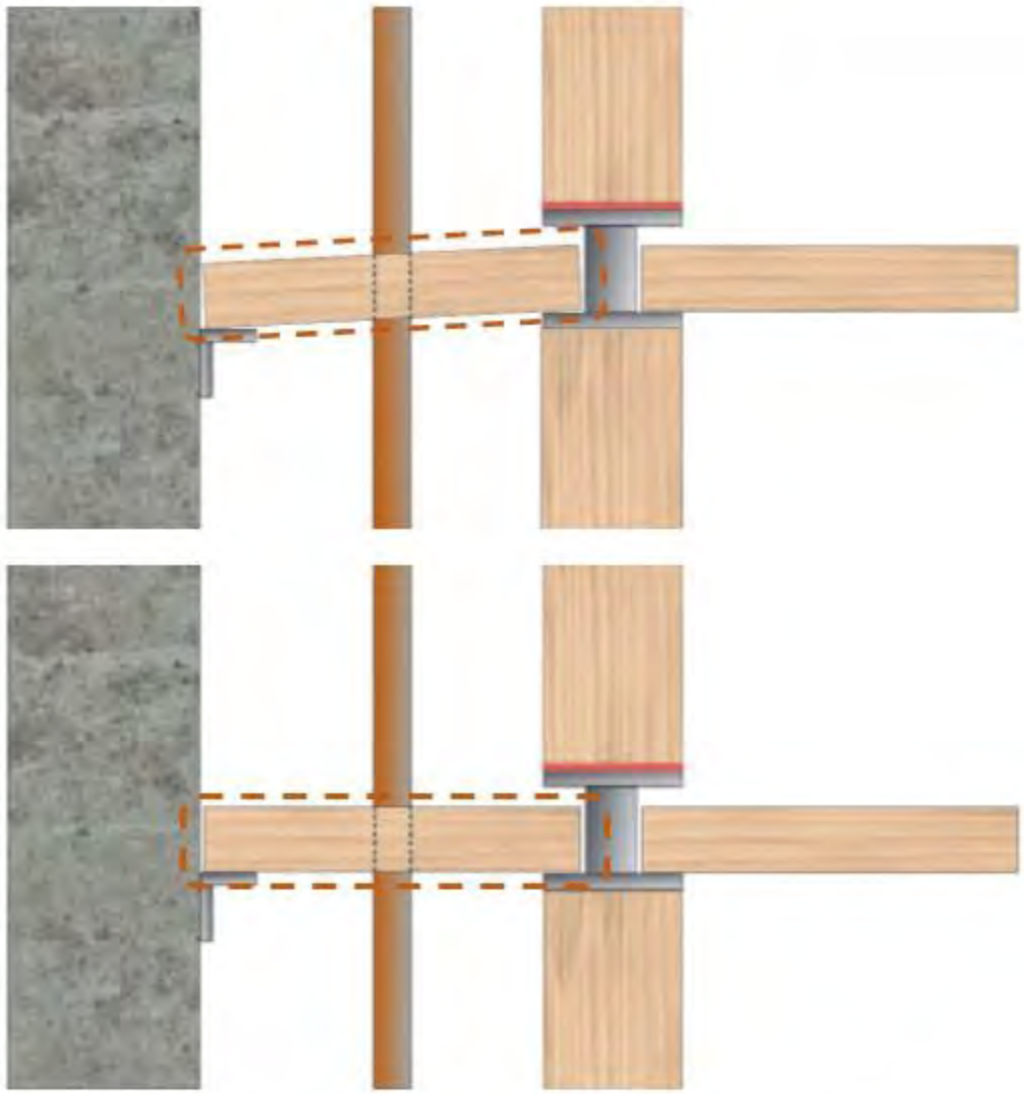
Connections are designed to address:

- Structural loading requirements
- Movement of different materials
- Transmission of vibrations
- Fire and life safety requirements
- Constructability

(Drawings: Acton Ostry)
(Images: Zahra Teshnizi, Erik Poirier)

AXIAL SHORTENING

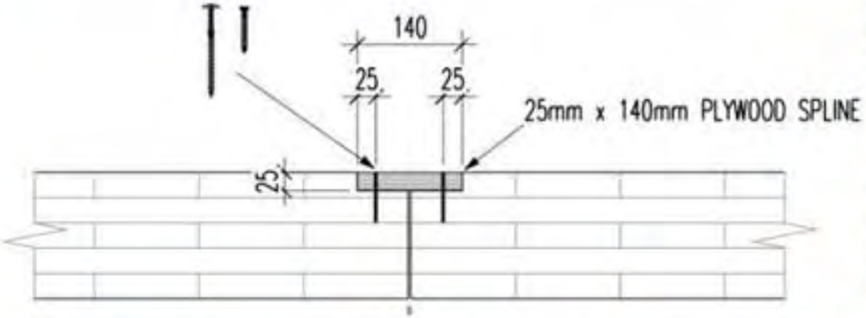
- Variable shortening rate between concrete cores and timber columns addressed by:
  - Increasing columns' height to allow for shortening
  - Using addition steel shim plates between column connections on 3 levels to ensure exact leveling
- On-site issue: less short-term shortening of columns than anticipated
- Solution: columns in one floor were shortened by 10 mm in the prefabrication facility



(Image: Acton Ostry)

LATERAL LOAD DESIGN

Concrete cores + slabs



Plywood splines

Steel drag-straps

(Images: Erik Poirier and Fast + Epp)

CLT VS CONCRETE CORES

Precedents show that using CLT for all structural components is possible (except foundations)

In Brock Commons:

› Use of CLT cores would have increased the project time, complexity, and cost

› The team chose to capitalize on the strengths of different material properties to compose an efficient hybrid structure

FORTE in Melbourne, Australia
(Images: Lendlease, Sourceable, Architel.tv)

PREFABRICATED ELEMENTS

Floor Panels

› CLT panels with cut-outs

Columns

› GLT and PSL columns with steel connectors on both ends

Envelope Panels

› Steel frame rainscreen panels with punched windows

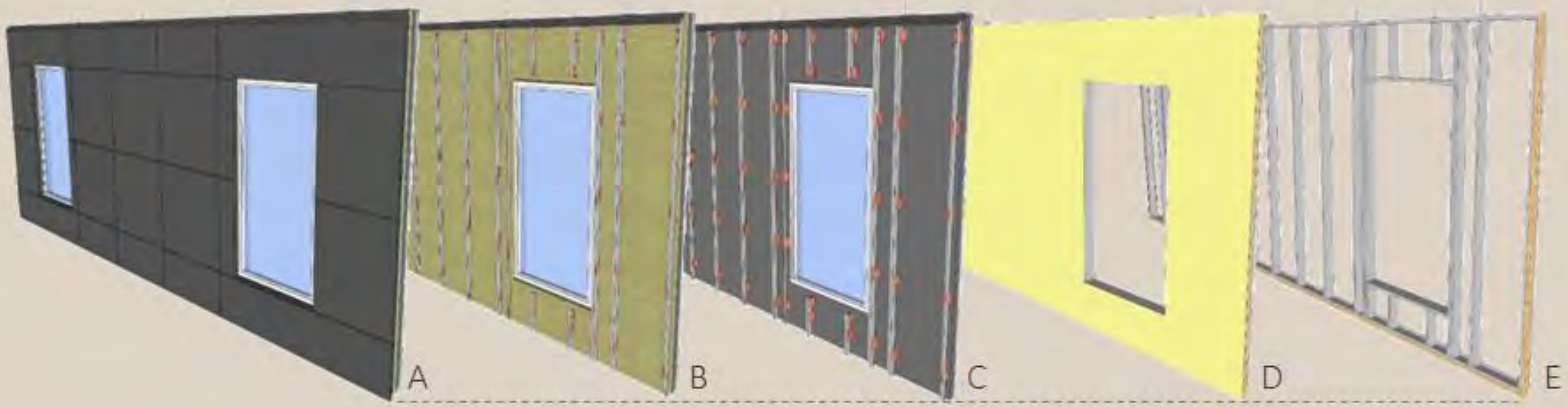
(Photo: naturally:wood)

MASS TIMBER MANUFACTURING

- All mass-timber components including penetrations and connection holes were prefabricated in 3 months
- Precise fabrication using CNC[1] machines allowed meeting tight tolerances
- Column steel connections were embedded as part of prefabrication process

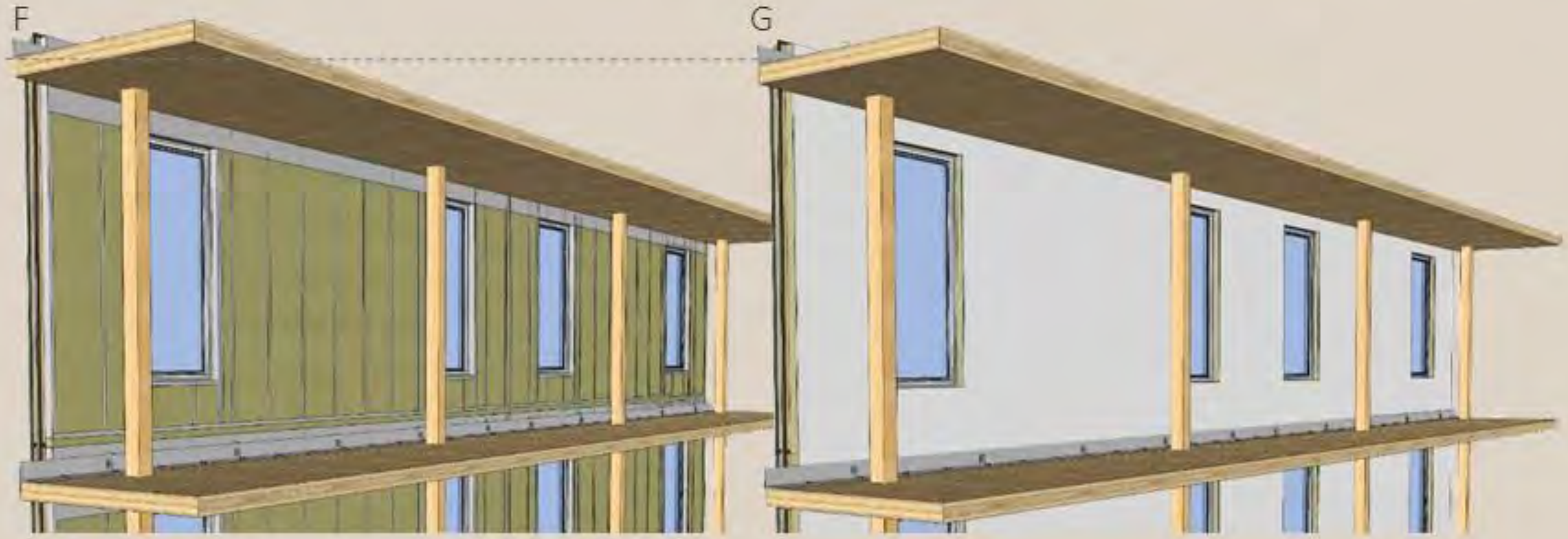
(Images: Structurlam and Azadeh Fallahi)

ENVELOPE PANEL COMPOSITION



Exterior Envelope Layers

A. Wood fibre laminate panels + punched windows
B. Stone-wool insulation
C. Liquid-applied membrane
D. Weather-proof drywall
E. Steel studs



Interior Envelope Layers

F. Fiberglass batt insulation + vapour barrier
G. Drywall

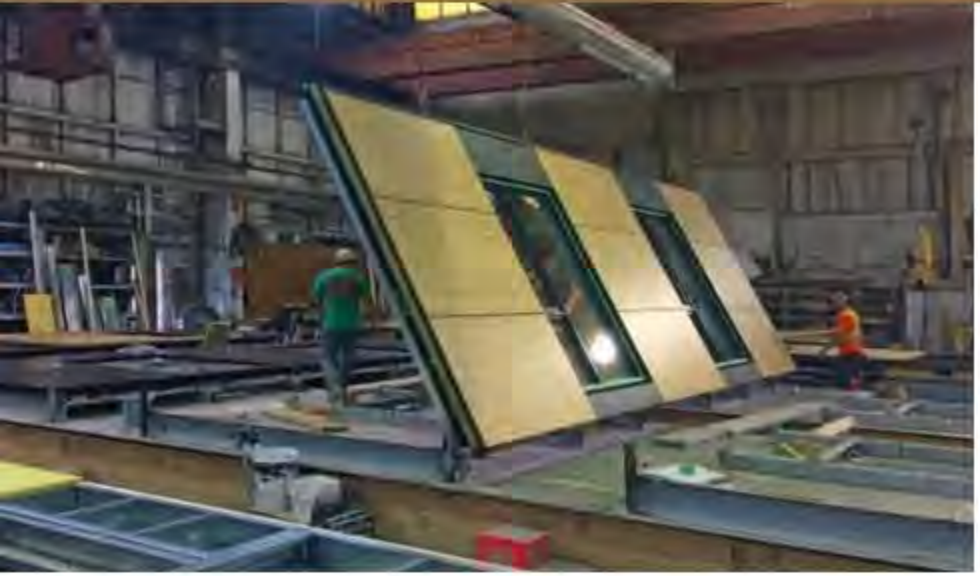
(Images: RDH Building Science)

BUILDING ENVELOPE

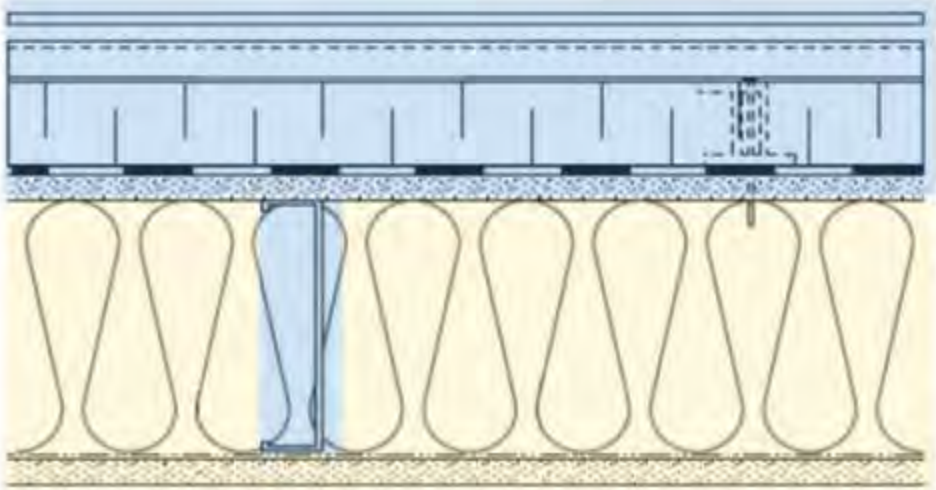
- Each floor has 22 panels
  - 2 corner panel types
  - 12 flat panel types
- Exposed concrete cores
  - Site-installed cladding panels
- Roof parapet
  - 2 corner panels types
  - 2 flat panel types

(Images: naturally:wood, Tim Herron)

ENVELOPE PANEL MANUFACTURING



- Partially prefabricated panels assembled at the plant with an interior to exterior sequence followed by window installation at the end
- Fabricated on special rigs welded to the ground with exact dimensions to meet tight tolerances



Prefabricated assembly
- pre-finished wood-fiber cladding
- semi rigid insulation
- vapour permeable membrane
- exterior sheathing board
- steel studs

Layers added on site
- fibreglass batt insulation
- vapour barrier
- gypsum board

(Images: Acton Ostry and Centura)

SHIPMENT OF PREFABRICATED ELEMENTS

- Just-in-time delivery
- Fabrication arranged in a linear process coordinated with the delivery to the site
- Trucks loaded in reverse order of actual installation and elements unloaded directly onto the building

(Images: Structurlam, Mohamed Kasbar, **Azadeh Fallahi**)

MASS TIMBER INSTALLATION

Installation process

- Panels lifted and positioned by crane and manually secured in place
- Screwed together with plywood splines and connected to cores with steel drag straps
- Bundles of columns craned up and manually lifted/fixed into place

Prefabrication advantages

- Fast installation: 2 floors per week
- Simple installation required small crews

(Image: naturally:wood)

ENVELOPE PANEL INSTALLATION

Installation process

- Panels hung from perimeter steel L-angle attached to each floor
- Panels clip similar to a curtain wall with overlap between them

Prefabrication advantages

- Fast installation: 1 floor per day
- Straightforward manual installation required small crews
- Installation from above eliminates need for scaffold system

(Image: naturally:wood)

GROUND FLOOR ENVELOPE

Curtain wall

- Standard glazed curtain wall

CLT Canopy

- Provides rain coverage for pedestrians
- Exposed wood for demonstration purposes
- Three-layered CLT panels with double folded standing seam metal roof

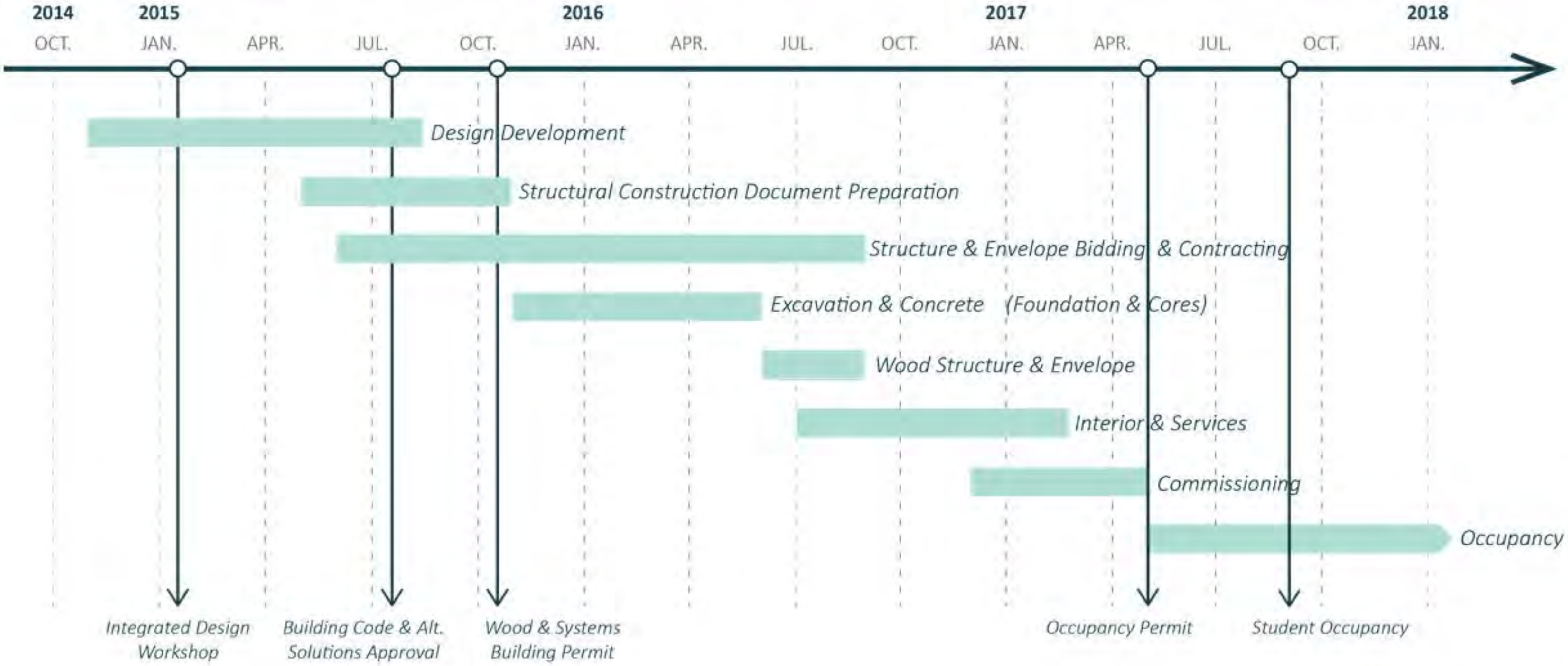
(Image: Acton Ostry and Zahra Teshnizi)

CONSTRUCTION SEQUENCE

(Video: naturally:wood and Thomas Froese; Edit: Salah Koleilat)

BROCK COMMONS TALLWOOD HOUSE

PROJECT TIMELINE



(Image: Laura Gilmore)

INTERIOR PARTITIONS & FINISHING

- Conventional steel stud
- Type X fire rated gypsum drywall
  - 2-hrs FRR[1] suite-to-suite
  - 2-hrs FRR vertical shafts
  - 1-hrs FRR suite-to-corridor
- Sound absorbing batt insulation
  - 50-62 STC[2] for wall assemblies
- Laminate particleboard cabinetry and millwork

(Images: Urban One)

MEP BUILDING SYSTEMS

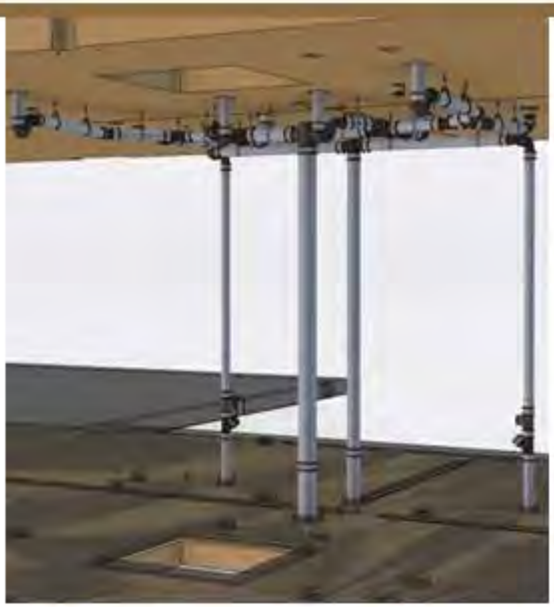
(Image: Acton Ostry)

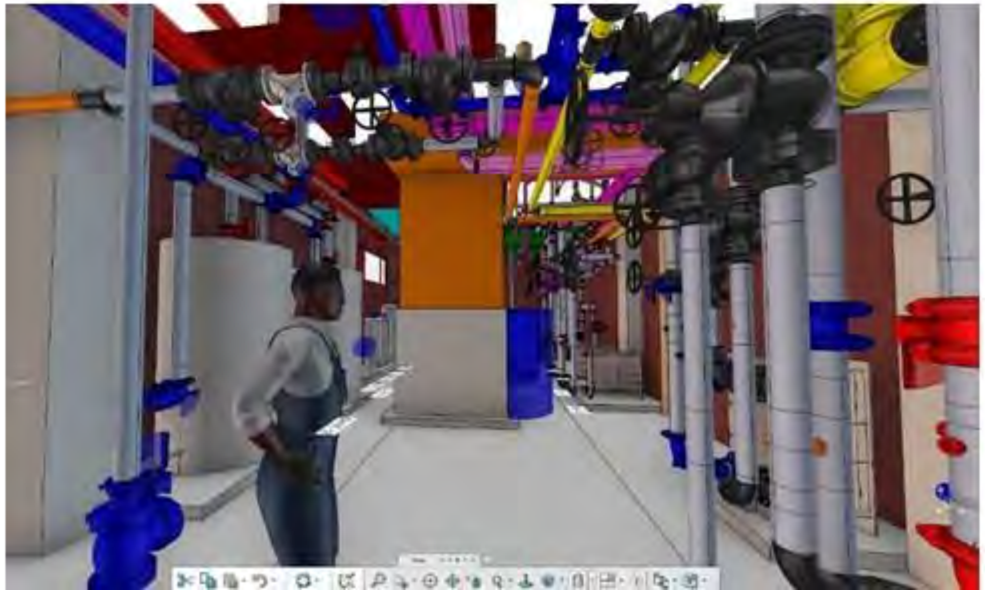
Use of conventional mechanical, electrical and plumbing systems

- Coordinated and detailed designs to limit slab penetrations and headroom requirements
- Additional drainage to reduce risk of water damage
- Flexibility to respond to building settlement and movement

MEP INSTALLATION

- MEP systems were fully modelled in VDC and precut off-site
- Plumbing was designed in 2 modular spool packages for all 17 floors
- Mechanical room
  - Cutting and welding of pieces were done off site
  - On-site Installation less than a month (vs. 3-4 month typical)




(Images: CadMakers Inc., Urban One, & Zahra Teshnizi)

BROCK COMMONS

FEASIBILITY, COMFORT & SAFETY

MODELS & TESTS

SAFETY & COMFORT MEASURES

CONSTRUCTION RISK MANAGEMENT

FULL SCALE MOCK-UP

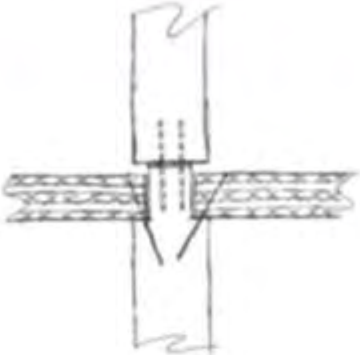
During design a mock-up of two typical floors was constructed to help optimize and validate critical design and construction decisions

- The mock-up tested:
  - Finishes
  - Envelope materials
  - Concrete topping
  - Connection details
  - Construction procedures and sequencing

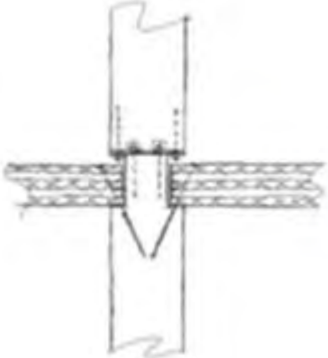
(Image: Erik Poirier)

CONNECTION ALTERNATIVES

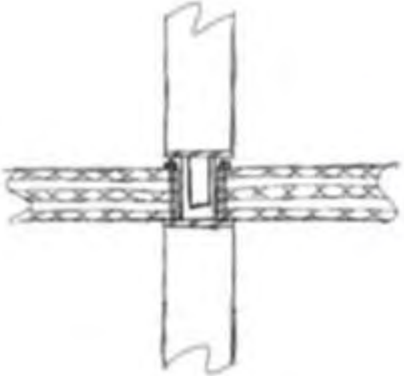
Connection A



Connection B



Connection C



- The mock-up allowed the team to test multiple connection details to optimize their constructability and structural performance

WINNER

(Images: Fast + Epp)

ENVELOPE ALTERNATIVES

Envelope A- Prefabricated Wood Frame Wall Panels

Envelope B- Prefabricated Pre-Cast Concrete Wall Panels

Envelope C- Prefabricated Steel Frame Wall Panels

WINNER

- The mock-up allowed the team to assess multiple envelope panels and cladding materials

(Images: RDH)

ENVELOPE PERFORMANCE TESTS

Lab mock-up tests included:

- Structural testing – wind at 100% and 150% of design load, seismic vertical and lateral drift
- Thermal cycling, thermal performance & condensation
- Air and water tightness before and after cyclical and structural testing

(Images: RDH)

CLT STRUCTURE SIMULATIONS

Structural Tests

- Conducted on a point supported CLT panel to understand how and at what point the panel would fail under a simulated load

Results

- CLT panels can withstand higher loads than anticipated
- Some capability found for CLT to redistribute forces as internal shear cracks propagated through the panel before critical failure

(Images: Fast + Epp)

CLT WEATHER TESTING

The project drew on moisture monitoring tests conducted for previous projects:

- Conducted to understand risks of North American and European CLT panel weathering during construction
- Results show that prolonged cyclical wetting & drying can damage CLT

CLT testing for previous projects (Images: RDH)

CLT MOISTURE SOLUTIONS

Challenges

- Weathering during construction
- Moisture added by concrete topping
- Floods in-service

Solution

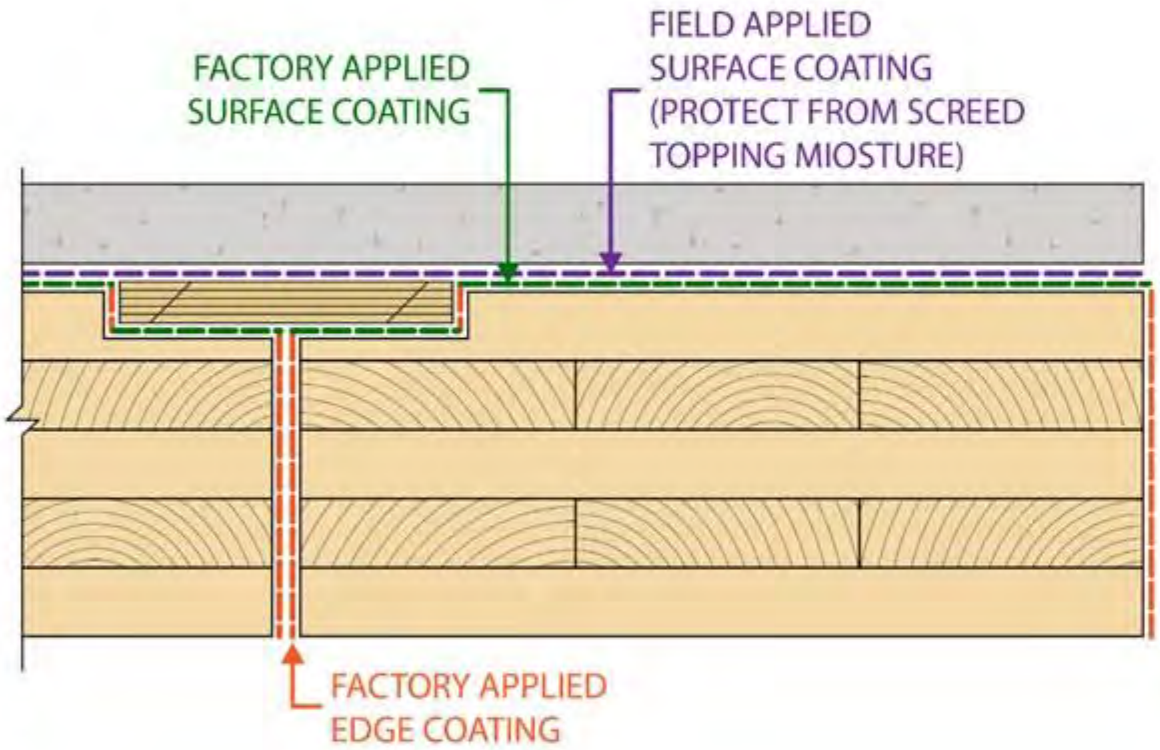
- Water repellant coating reduces wetting and keeps moisture content

On-site challenge

- Concrete topping delamination from CLT in various areas due to the waxy sealant

Solution

- Concrete topping was mechanically re-attached



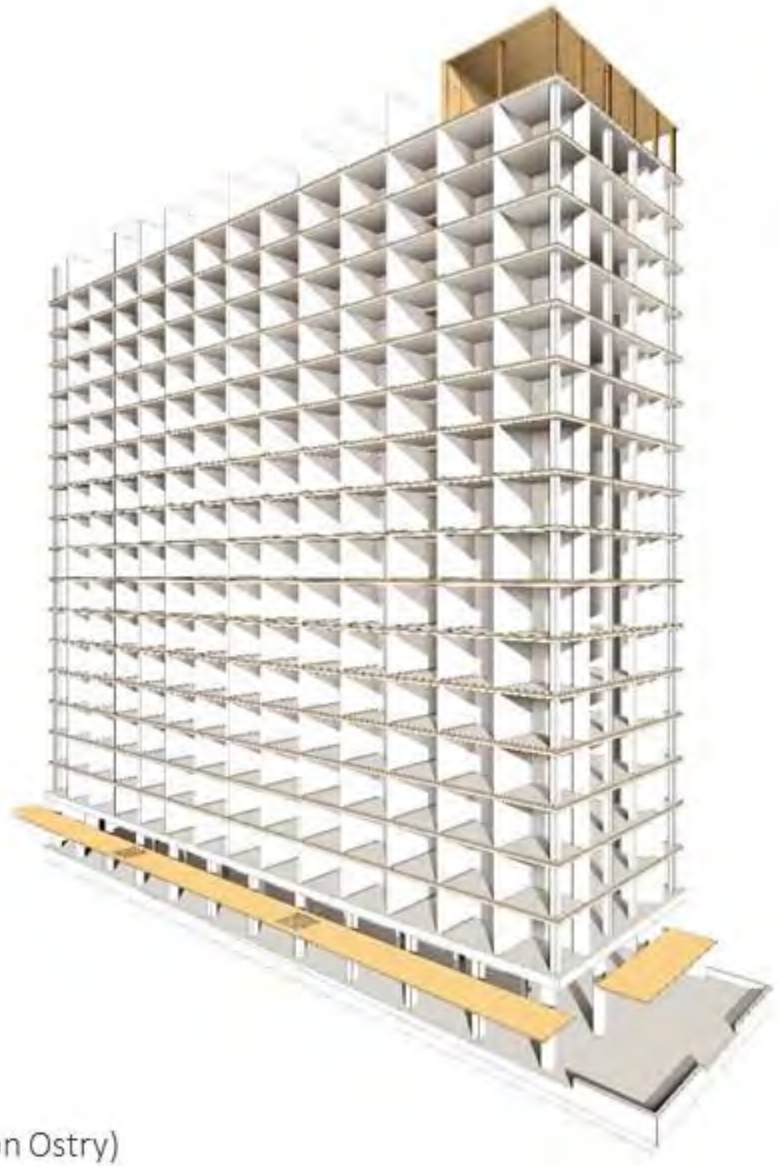
(Image: RDH)

ENCAPSULATED CLT FIRE TESTS

- The project drew on previous materials research:
  - A test conducted for a previous project demonstrated the fire performance of full-scale CLT structure
  - The test showed that a 2h non-standard severe design fire did not affect the structural integrity of the demonstration CLT shaft
- In addition, firestop testing of the floor assembly with typical mechanical penetrations was performed specifically for this project

(Images: NRCC)

FIRE PROTECTION - ENCAPSULATION



(Image: Acton Ostry)

Wood structure is completely encapsulated:

- Provides code-required fire resistance
  - 2-hr for structure, floors, shaft and suite-to-suite walls
  - 1-hr for suite-to-corridor walls

ACTIVE FIRE-SUPPRESSION SYSTEMS

Typical systems used in high-rises:

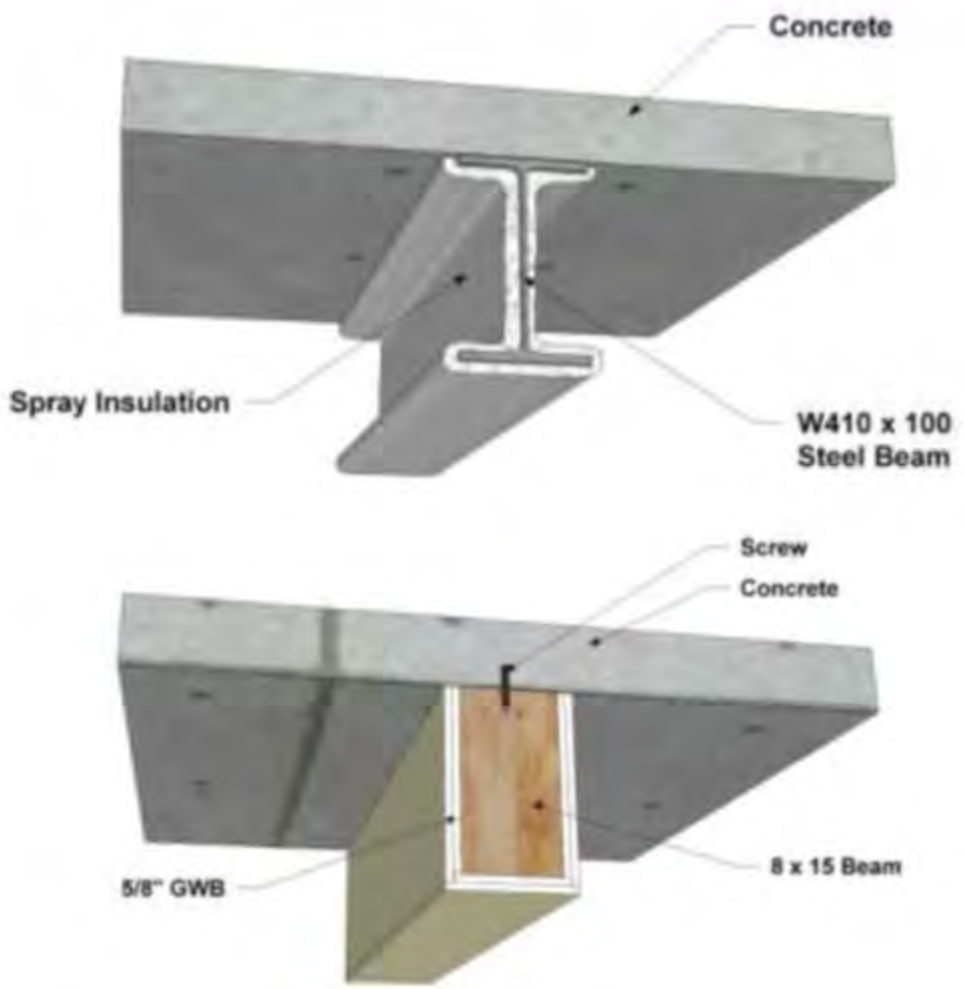
- Fire alarm system
- Automatic sprinkler system
- Standpipe system
- Water curtain on ground level
- Fire extinguishers on each floor

Additional measures:

- Expansion joints where risers exit the concrete cores
- 20,000 litre on-site back-up water tank and fire pump

Sprinkler System Expansion Joint
(Image: Zahra Teshnizi)

STEEL AND WOOD FIRE RISK COMPARISON



(Image: GHL Consultants)

Steel encapsulation

- Industry practice
- Spray insulation around steel beams
- Need for encapsulation: Steel cannot be exposed due to its critical temperature

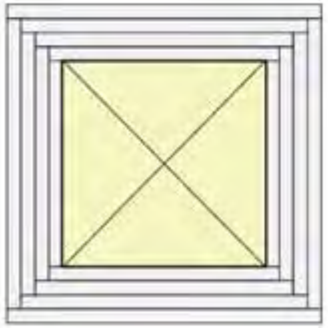
Mass timber encapsulation

- Proposed solution for Tallwood House
- Consists of 3 fastened gypsum boards
- Need for encapsulation: fire protection before wood begins charring

FIRE PROTECTION RELIABILITY

Charring
of mass timber structure

Encapsulation
3-4 layers of gypsum



Sprinklers +
Back-up water supply

(Images: Laura Gilmore)

Design is based on minimal to no charring

- Multiple layers of Encapsulation:
  - Prevents fire spread & growth
    - *Equivalent to non-combustible*
  - Prevents structural collapse *(2h FRR[1])*
    - *Exceeds non-combustible*
- Sprinklers & backup water supply
  - Addresses active protection
    - *Exceeds non-combustible*

WHY NOT EXPOSED WOOD?

(Images: Acton Ostry)

Reasons to not expose mass timber elements in the building:

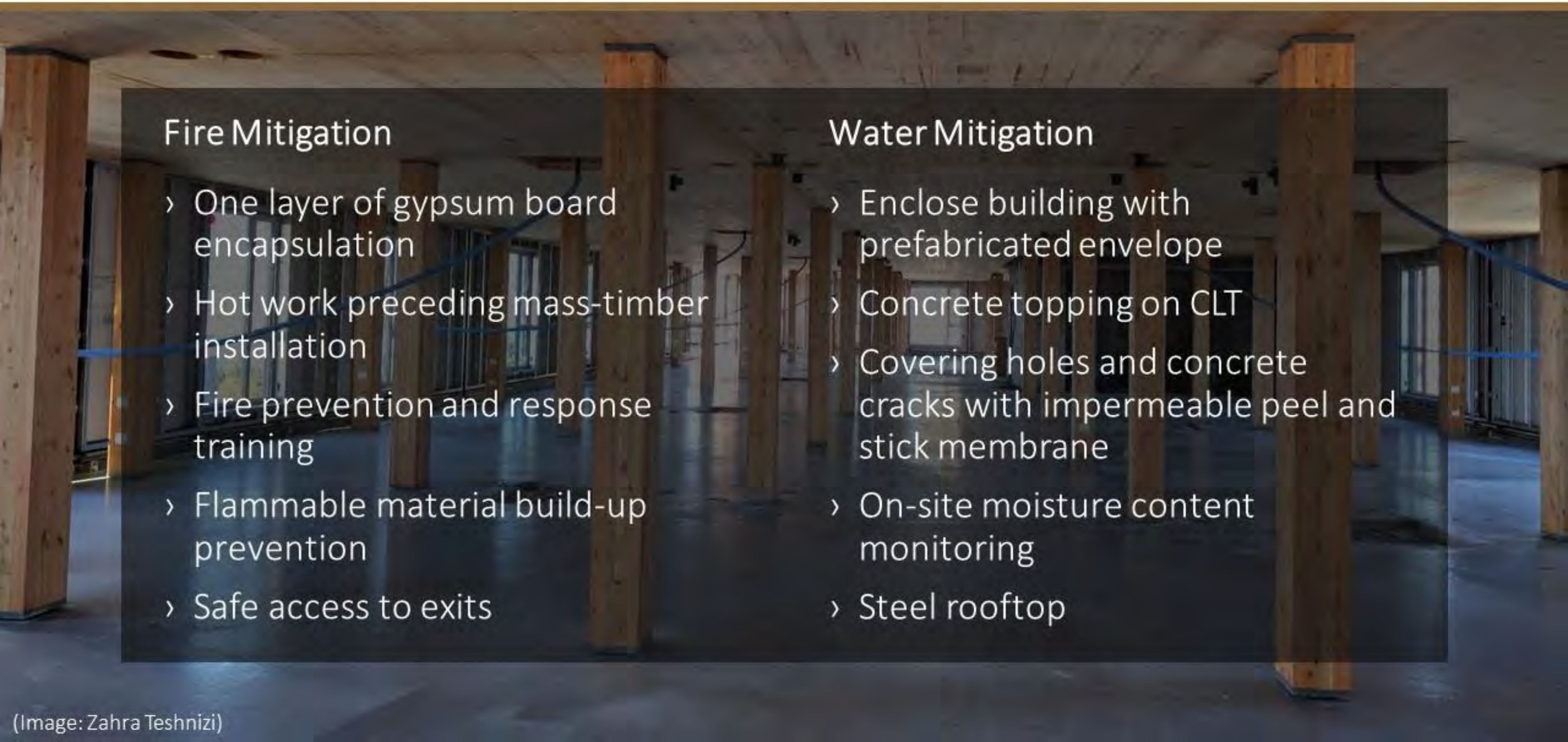
- Simplified the regulatory approval process, reducing the approval time and complexity of the SSR
- Facilitates building maintenance and repair over time
- Part of a strategic approach to innovation and replicability of the design approach

ACOUSTIC DAMPENING

(Image: Acton Ostry)

- Concrete topping on the CLT panels
- Cover floors with carpet or resilient tiles
- 3 layers of type X gypsum board on walls and ceilings
  - Dampens acoustic transmissions through and vibrations within the structure
- Ceiling steel assembly with air space designed for acoustic performance

CONSTRUCTION RISK MANAGEMENT



Fire Mitigation

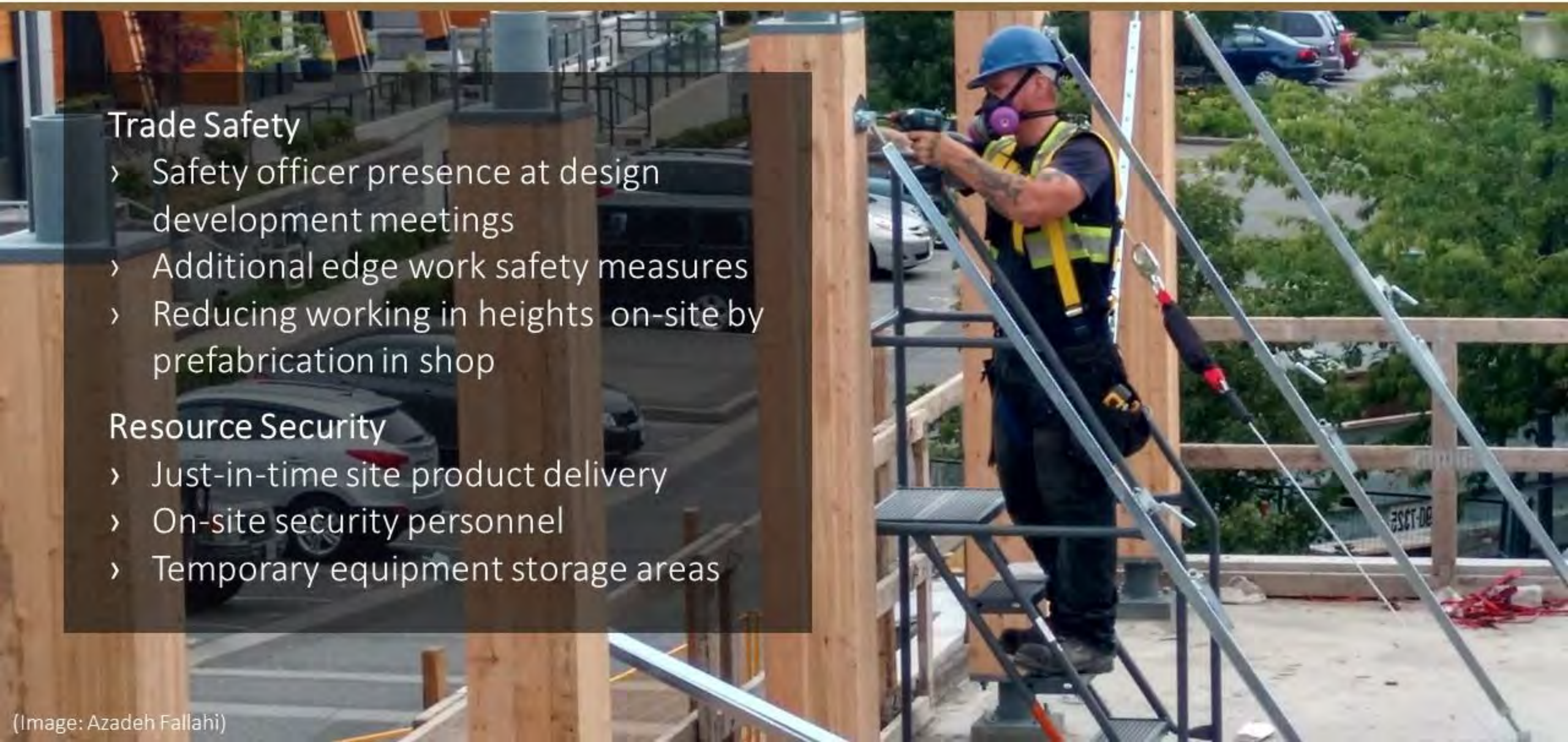
- One layer of gypsum board encapsulation
- Hot work preceding mass-timber installation
- Fire prevention and response training
- Flammable material build-up prevention
- Safe access to exits

Water Mitigation

- Enclose building with prefabricated envelope
- Concrete topping on CLT
- Covering holes and concrete cracks with impermeable peel and stick membrane
- On-site moisture content monitoring
- Steel rooftop

(Image: Zahra Teshnizi)

SITE SAFETY AND SECURITY



Trade Safety

- Safety officer presence at design development meetings
- Additional edge work safety measures
- Reducing working in heights on-site by prefabrication in shop

Resource Security

- Just-in-time site product delivery
- On-site security personnel
- Temporary equipment storage areas

(Image: Azadeh Fallahi)

BROCK COMMONS

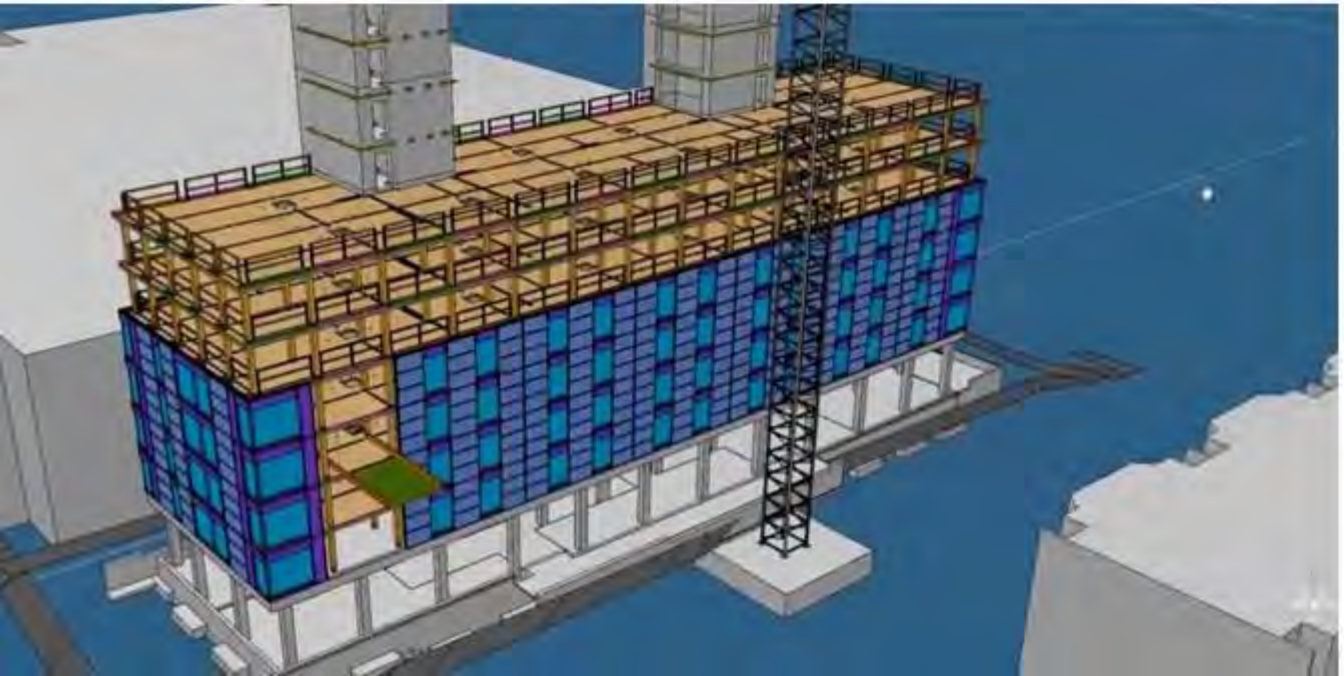
KNOWLEDGE TRANSFER

INNOVATION STRATEGIES

RESEARCH AND EDUCATION

MASS TIMBER FUTURE

INNOVATION STRATEGIES - DESIGN



- Simple and replicable design solutions
  - Facilitate approval process
  - Steppingstone for future projects
- Integrated Design Process
  - Design-assist trade
  - Advisory architect
  - Construction manager
- Iterative design process
  - Virtual Design and Construction (VDC) modeling
  - Full-scale mock-ups and tests

(Images: Urban One, naturally:wood & CadMakers Inc.)

INNOVATION STRATEGIES - CONSTRUCTION

- Maximized prefabrication opportunities
  - Increased accuracy of manufacturing
  - Accelerated construction process
  - Fast enclosure of the mass timber
  - Reduced on-site work and waste

(Images: Azadeh Fallahi & **naturally:wood**)

SUSTAINABILITY FEATURES

Volume of wood:
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

EQUIVALENT TO:

511 cars off the road for a year

Energy to operate a home for 222 years

Source: US EPA

- Lighter structure
- Wood avoids and sequesters carbon
- Certified wood from sustainable forestry sources

- LEED v4 Gold certification
  - Min. 25% energy savings (ASHRAE 90.1)
  - 86% on-site waste diversion
- Connected to UBC District Energy System
- High thermal performance envelope (R-Value of 16 minimum effective)
- Automatic heating shutdown

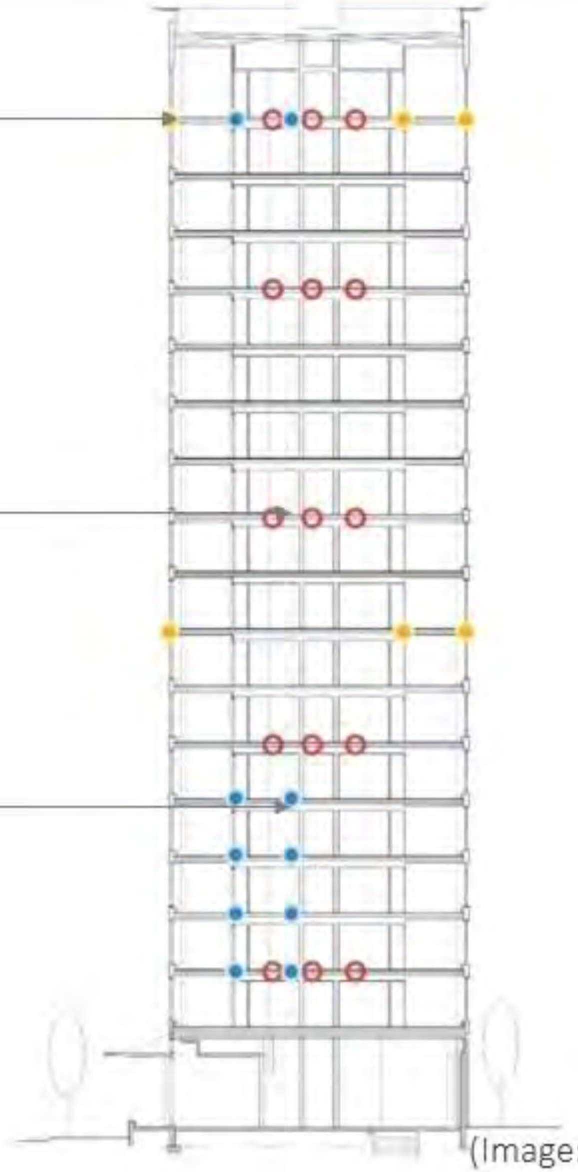
BUILDING PERFORMANCE MONITORING

Goal

Validate design through performance and refine design strategies for future buildings

Monitoring Systems

- CLT Moisture Monitoring
  - Point Moisture Measurement (PMM) sensors for moisture content values
- Vibration Monitoring
  - Accelerometers for 3-Way vibration analysis
- Vertical Displacement Monitoring
  - String-and-Pot sensors for elastic and inelastic shortening measurement



(Image: Acton Ostry)

PROJECT TRACKING

Goal

Document lessons learned from the project

Information Collection

- Design and pre-construction phase
- Manufacturing processes and quality control
- Construction phase
- Commissioning and post-occupancy phase

(Image: Mohamed Kasbar)

EDUCATION & OUTREACH

Goal

Share knowledge and experience with building industry members, educators and students

Knowledge Sharing

- Environmental and financial impacts of wood structure
- Design and construction processes
- Future mass timber building strategies
- Practices, policies, and regulations

(Image: Zahra Teshnizi)

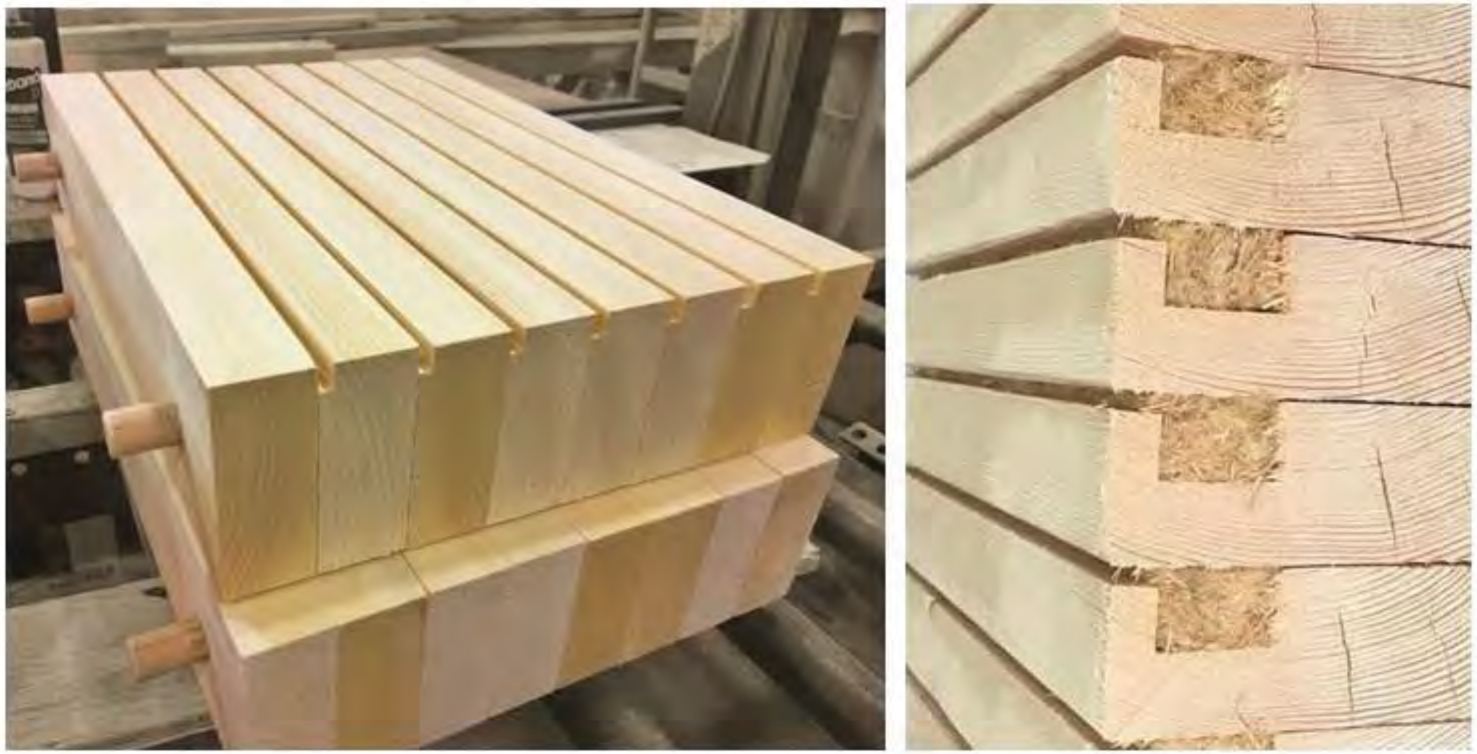
UPCOMING TALL WOOD BUILDINGS – N. AMERICA

Arbora | 8 storeys
Montreal, Canada
(Photo: Lemay+CHA)

Framework | 12 storeys
Portland, USA
(Photo: Lever Architecture)

Terrace House | 19 storeys
Vancouver, Canada
(Photo: PortLiving)

NEW MASS TIMBER PRODUCTS



Dowel Laminated Timber (DLT)
No glue, no nails
Floor, wall, and roof
(Photo: structurecraft.com)

Mass Plywood Panel (MPP)
Veneer based
Floor, wall, and roof
(Photo: frereslumber.com)

ADDITIONAL INFORMATION

For additional information on Brock Commons Tallwood House please visit:

naturallywood.com

PROJECT OVERVIEW PRESENTATION | March 2017

Prepared by: The University of British Columbia's Centre for Interactive Research on Sustainability and Forestry Innovation Investment

UBC sustainability