PHILADELPHIA
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Enclosure Design for Mass Timber Buildings

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RDH

Making Buildings Better

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

Course Description

Larger and taller mass timber buildings are becoming common in North America. These buildings typically utilize CLT or NLT panels, glulam beams and columns, and new engineered timber components to meet the structural and fire requirements associated with greater heights. With these larger wood structures and heavier timber components comes the need for efficient building enclosure assemblies that can be installed quickly on tight sites and are in many cases new and unique to the industry. Prefabricated building enclosure elements are now also commonly used. This presentation shares guidance on building enclosure design and detailing best practices for mass timber buildings. It includes case studies and lessons learned from the design, construction, and monitoring of enclosures for recently completed projects.

Learning Objectives

At the end of this course, participants will be able to:

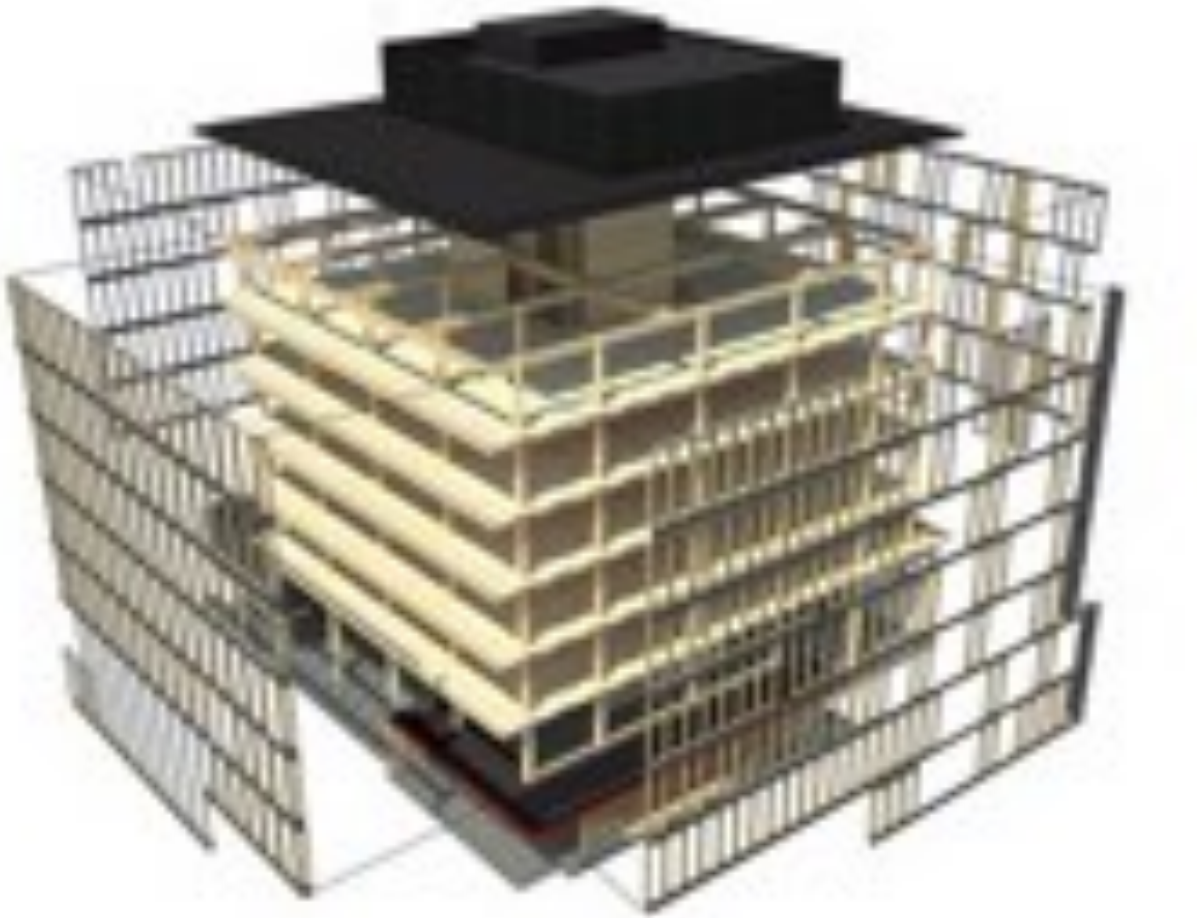
- → Review building science fundamentals and building enclosure design considerations for mass timber buildings.
- → Discuss common details used for mass timber wall and roof enclosure assemblies.
- → Highlight the potential for increased construction efficiency through the use of prefabricated enclosure assemblies.
- → Referencing case studies and details from recently completed mass timber projects, demonstrate lessons learned and best practices associated with enclosure assemblies.

OUTLINE

1. Building enclosure design + mass timber
2. Lessons learned
3. Case Study – Wood Innovation Center
4. Case Study – Brock Commons
5. What’s Next?

Building Enclosure Design & Constructability

Structure



The Building Enclosure

Tall Wood Structures

- Fast
- Sensitive to moisture
- Greater movement – shrinkage
- Code Challenges?
- Mixed steel, concrete, and wood

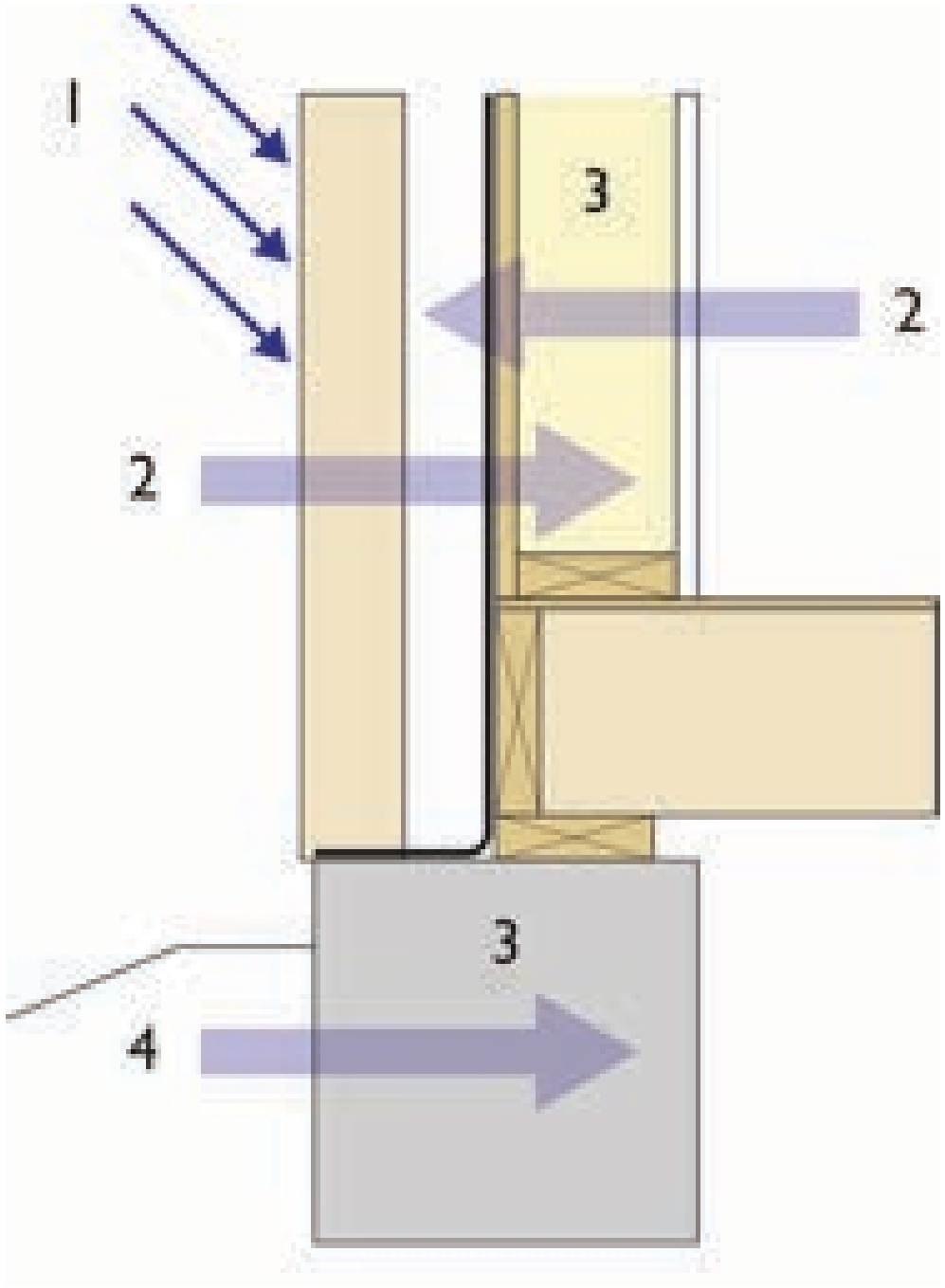
- Not the same as stick-built
- Not the same as high-rise

Tall Wood Building Enclosures

- Need for speed
- Protect wood structure from inclement weather
- Robust materials and systems, high-rise appropriate
- Tolerant of movement
- Thermally efficient

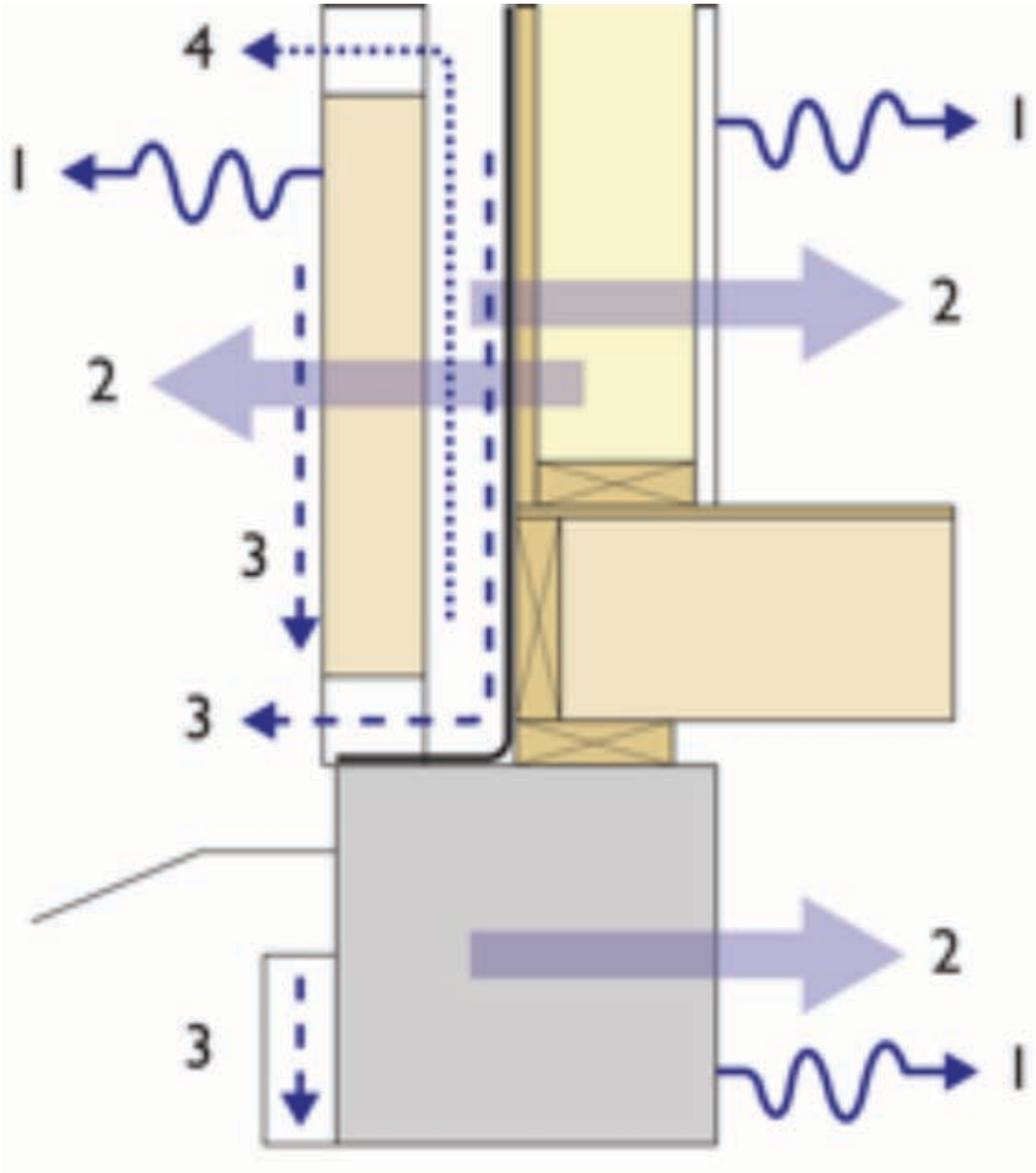
Water Management - Wetting

1. Precipitation
2. Vapor / air movement
3. Construction moisture
4. Groundwater



Water Management - Drying

1. Evaporation
2. Vapor / air movement
3. Drainage
4. Ventilation drying




Tyvek

Ronald McDonald House – Vancouver, BC

Ronald McDonald House – Vancouver, BC

First Tech Credit Union – Hillboro, OR

Carbon 12 – Portland, OR

Lessons Learned


SEAL

Lessons Learned - Roofs

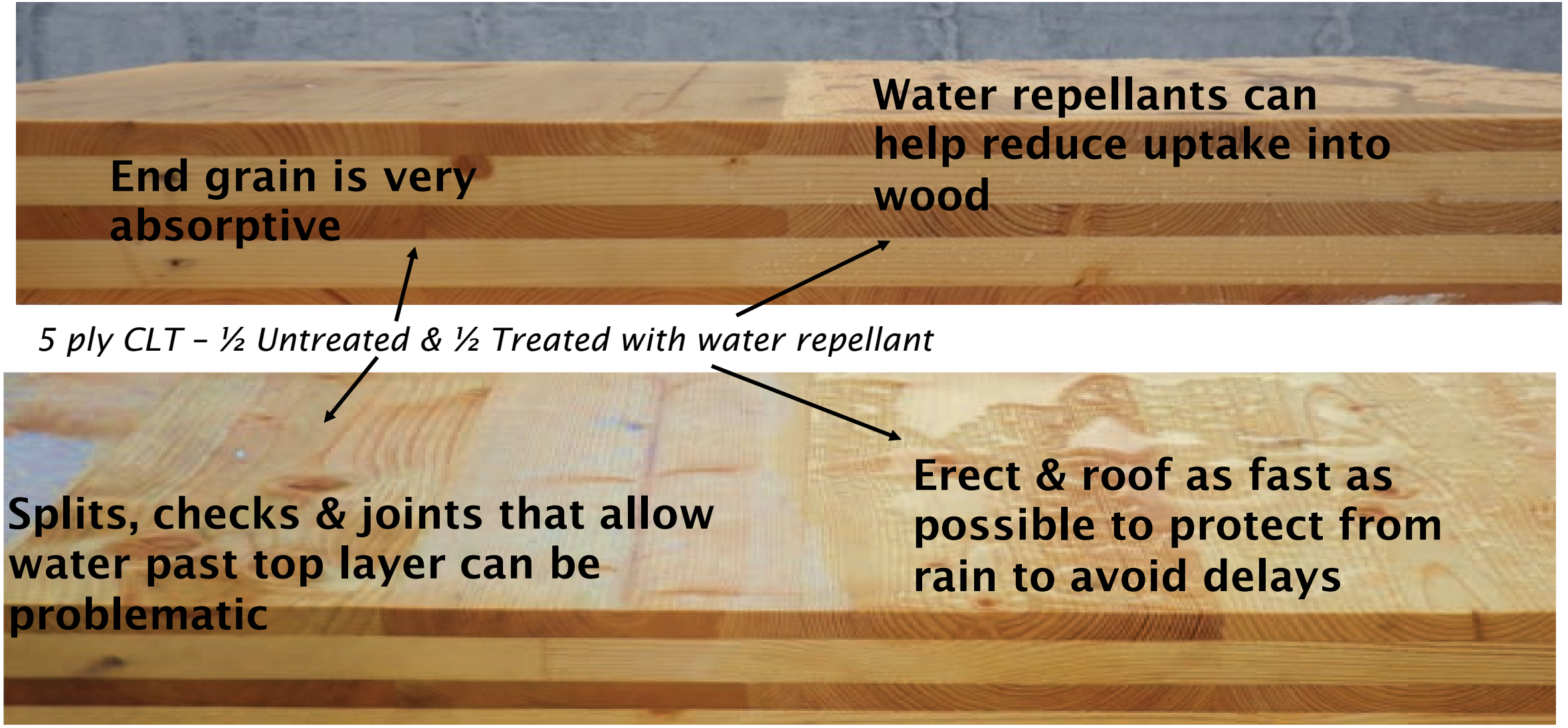
- Protect large wood roofs from rain – but not too late

- Mechanical drying of wetted roofs is slow & causes costly construction delays


EXIT


HILTI

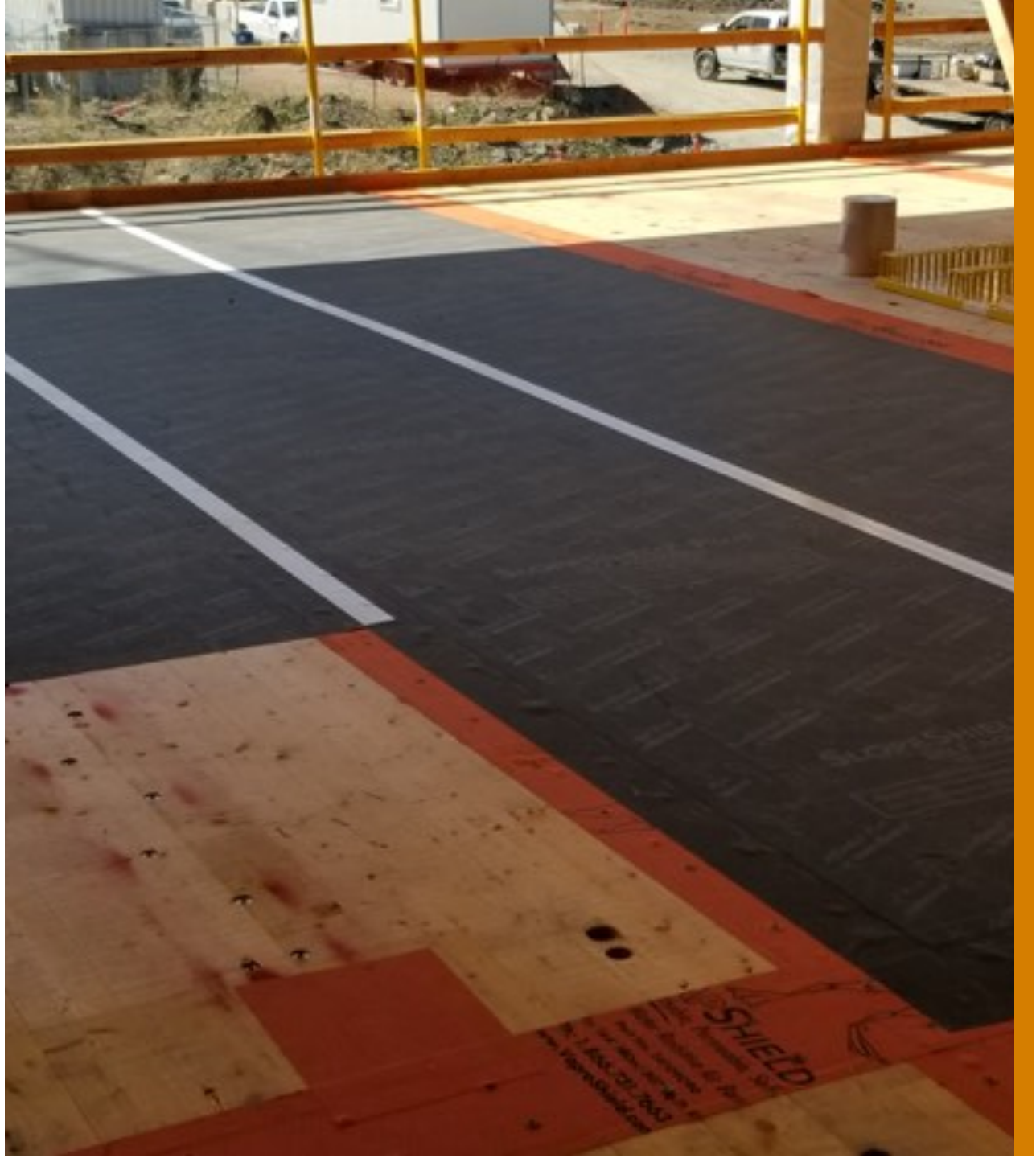
Industry Lessons - Protection




NAIL-
LAMINATED
TIMBER
U.S. DESIGN &
CONSTRUCTION
GUIDE v1.0

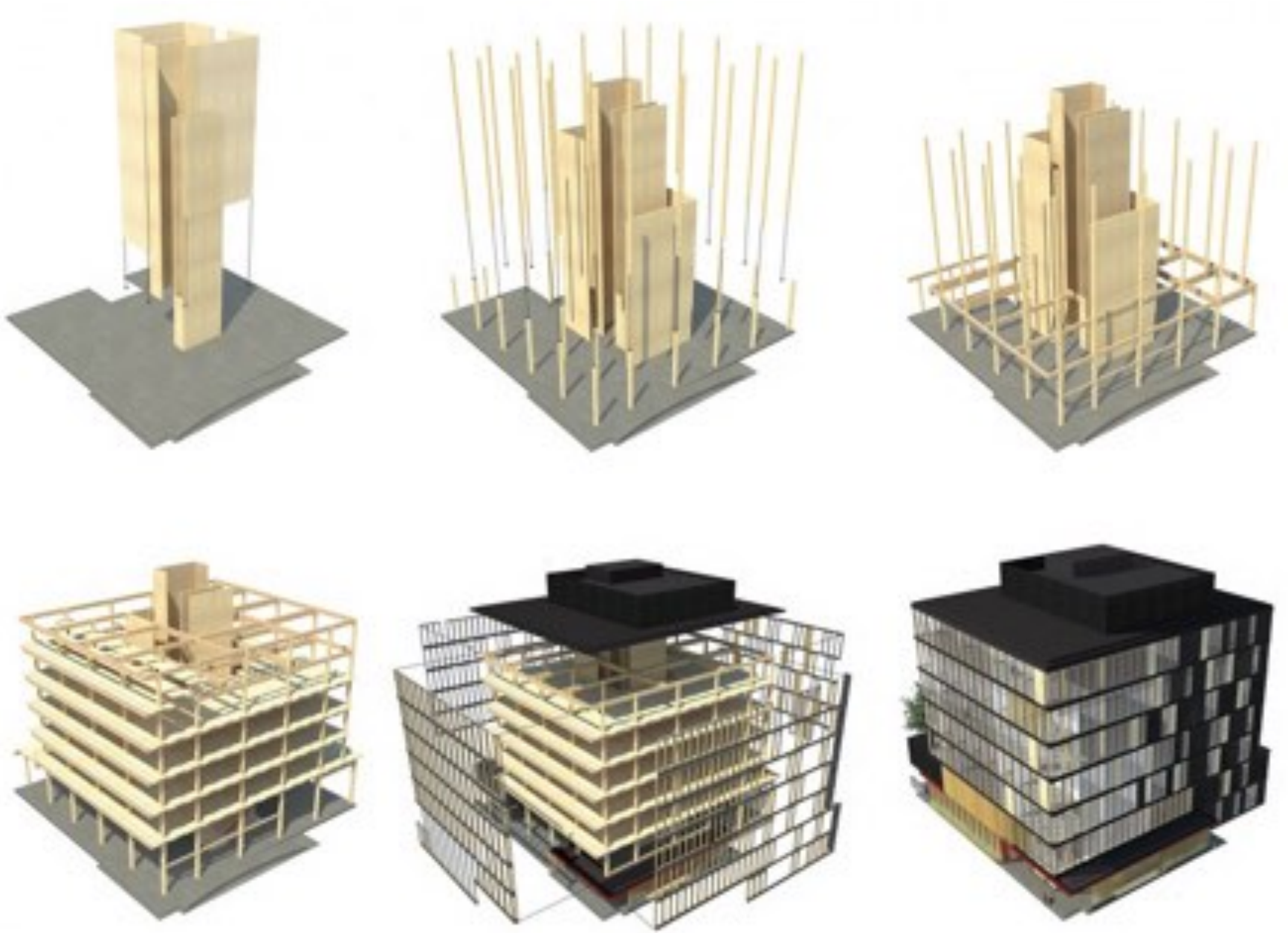
Moisture Management Planning

- Both factory or in-field options
- End grain has most risk – consider covering joints
- Consider moisture load associated with wet concrete toppings – either structural or acoustic
  - Acoustic mat or top coating membrane recommended
  - Ensure wood is dry prior to concrete placement
- Field of panel is lowest risk – consider climate and seasons



Wood Innovation Center

WIDC – Structure & Enclosure Systems



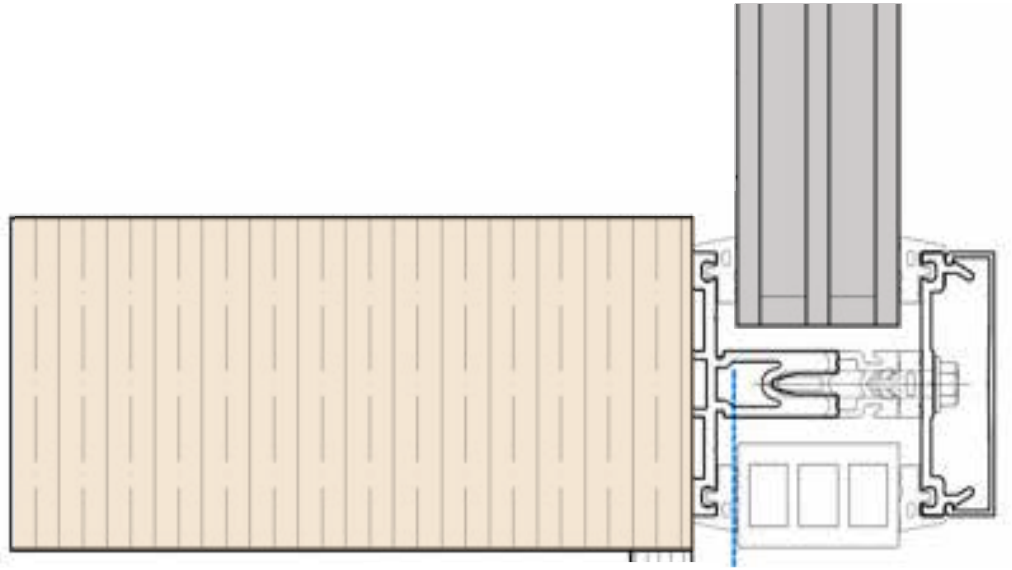
Wood Innovation Design Center

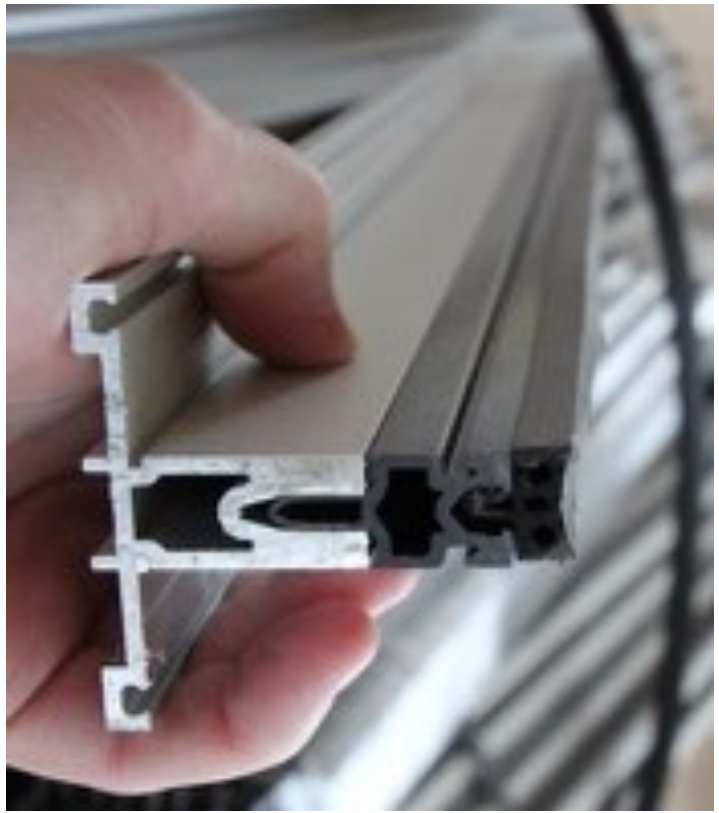
- 6 ‘tall’ levels (equivalent to 8 levels, 98’ tall)
- CLT shear walls, glulam columns with glulam beams and staggered CLT floor & roof structure
- Thermal performance design targets
  - R-40 roof
  - R-25 walls
  - R-5 wood curtainwall glazing
- Pre-fabricated design for infill walls and wood curtain wall

Michael Green Architecture (MGA) – Contractor: PCL Construction

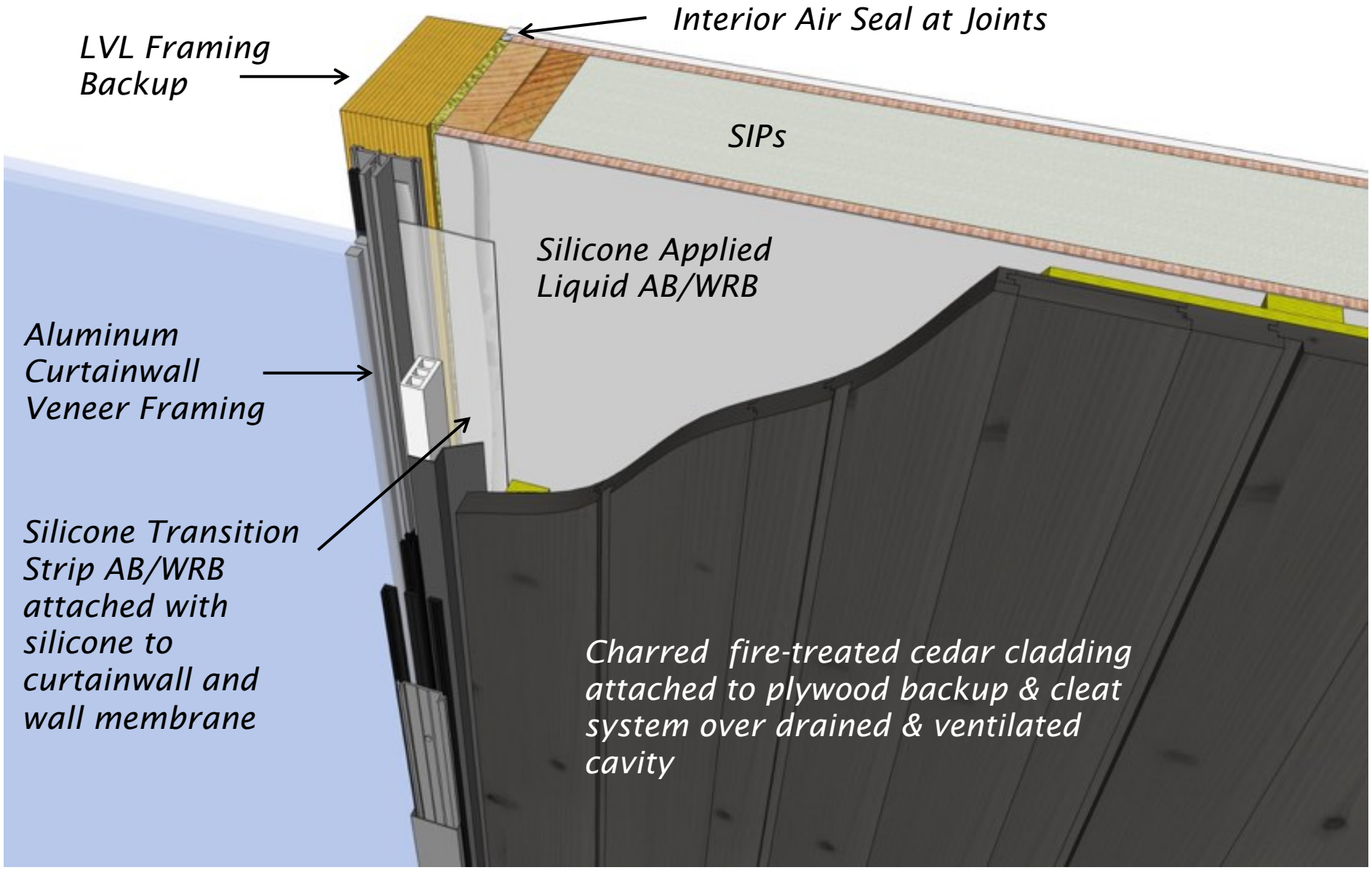
Stick-Built Wood Veneer Curtainwall

- Aluminum veneer curtainwall framing over LVL mullions - installed as individual window units, ground bearing
- Stick built/site glazed with triple glazed IGUs, argon filled, dual low-e coatings (U-0.15)
- R-5 (U-0.20) overall thermal performance





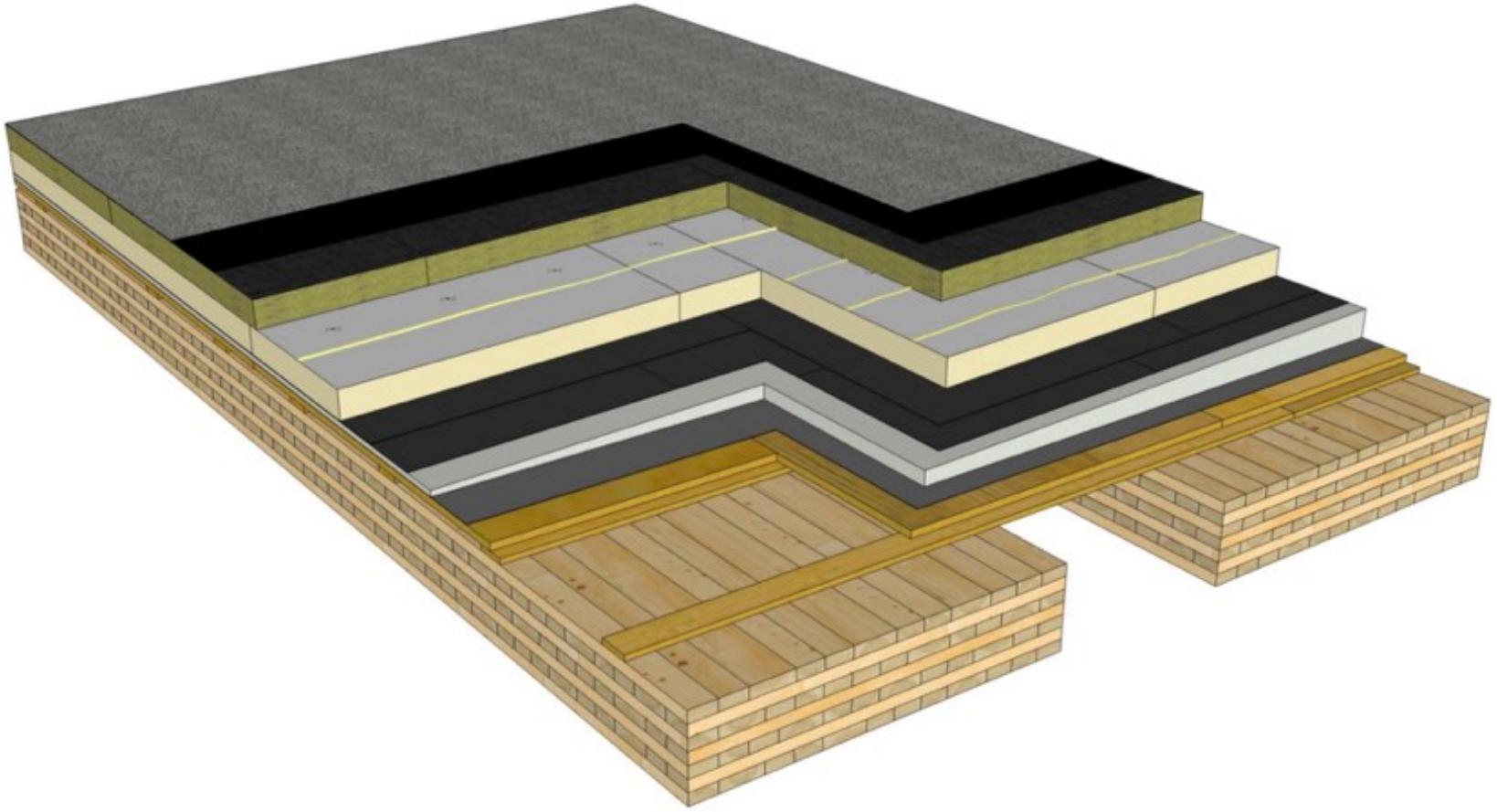
Curtainwall to SIPs Interface



Charred Fire-Treated Cedar Cladding Panels

John Boys, Nicola Log-works

Conventional Roof Assembly

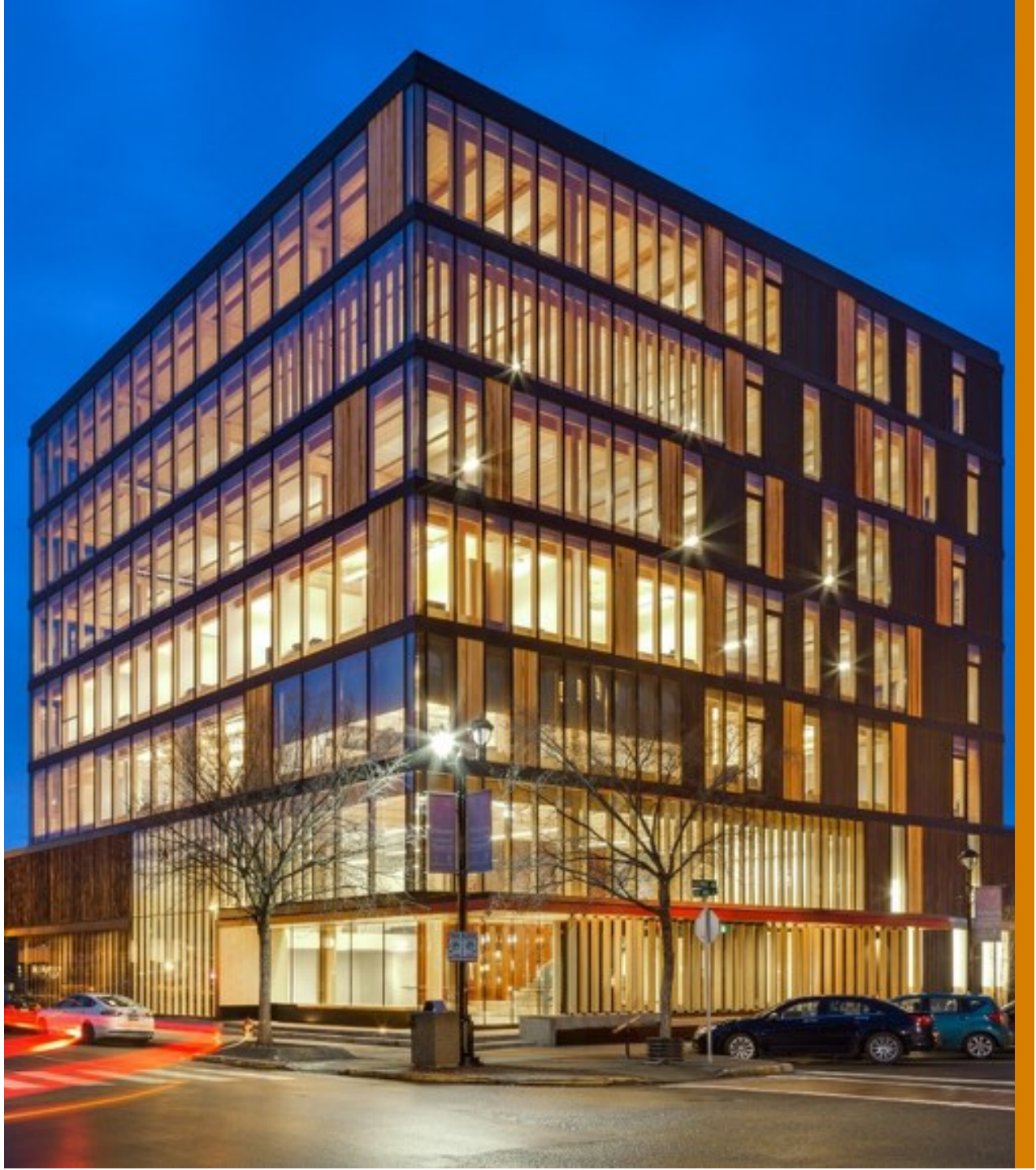


Conventional Roof Assembly

Wood Innovation Design Center

WIDC – Summary

- Durable and energy efficient
- High performance materials and systems
- Small panel pre-fabrication
- Required full exterior access during construction
- Scaffolding, exterior sealants and transition details




Brock Commons

Initial Challenges

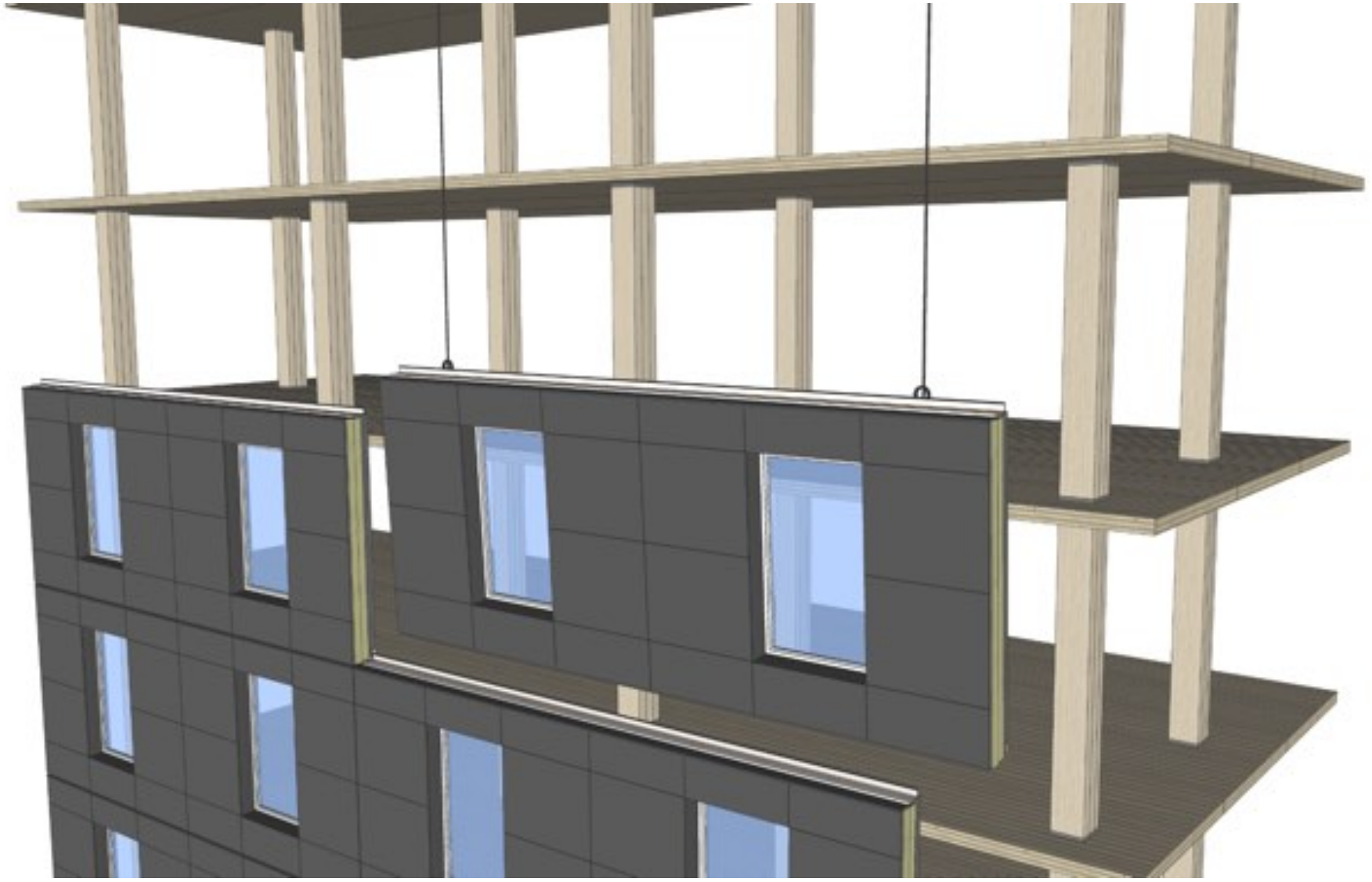
- Vancouver = Temperate rainforest
- How to protect mass timber from rain during construction in any season?
- Enclosure must keep up with pace of structure
- How to enclose & seal the walls quickly and not be slowed by inclement weather?

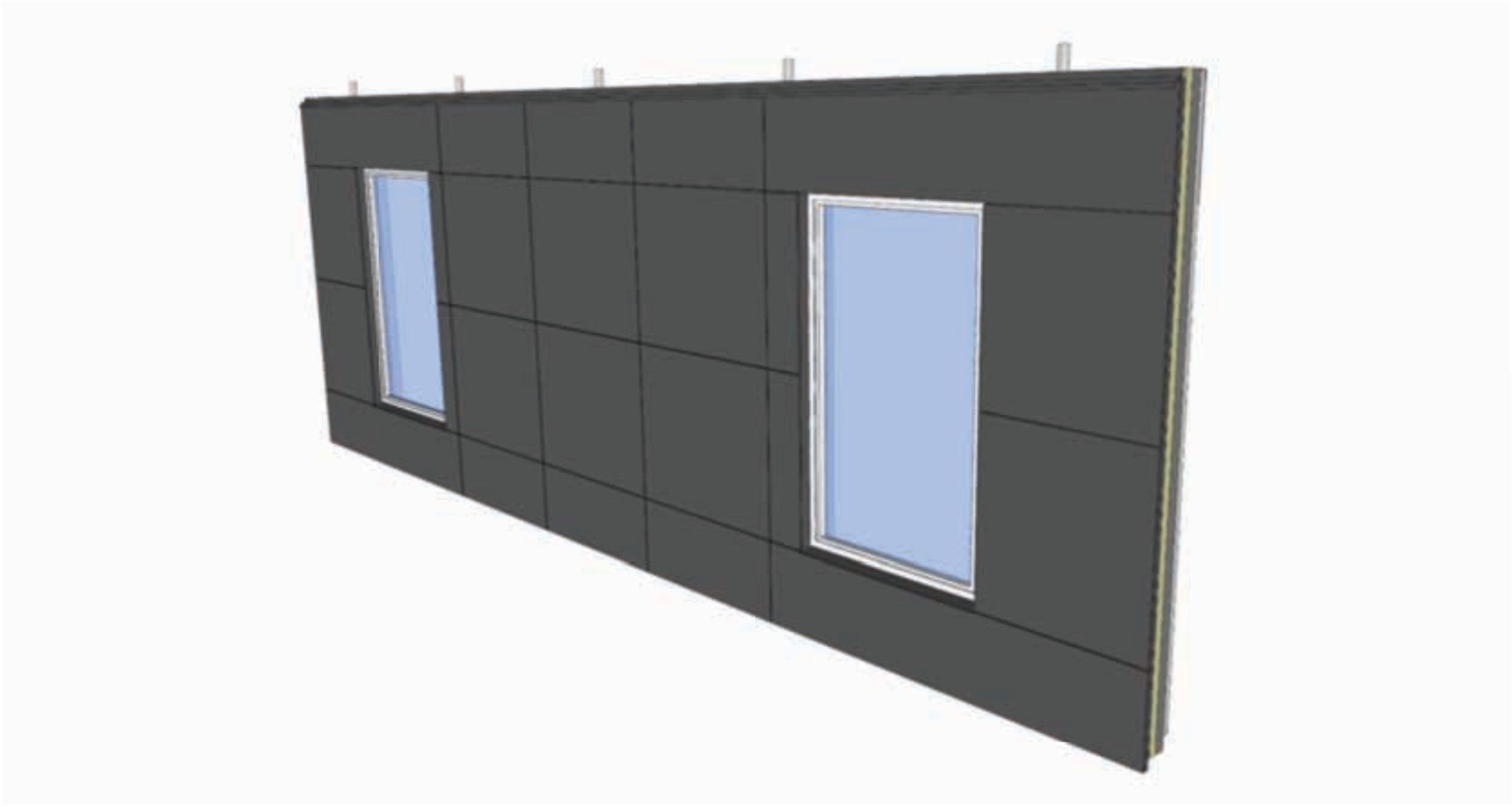
UBC Brock Commons- What Wasn't Feasible

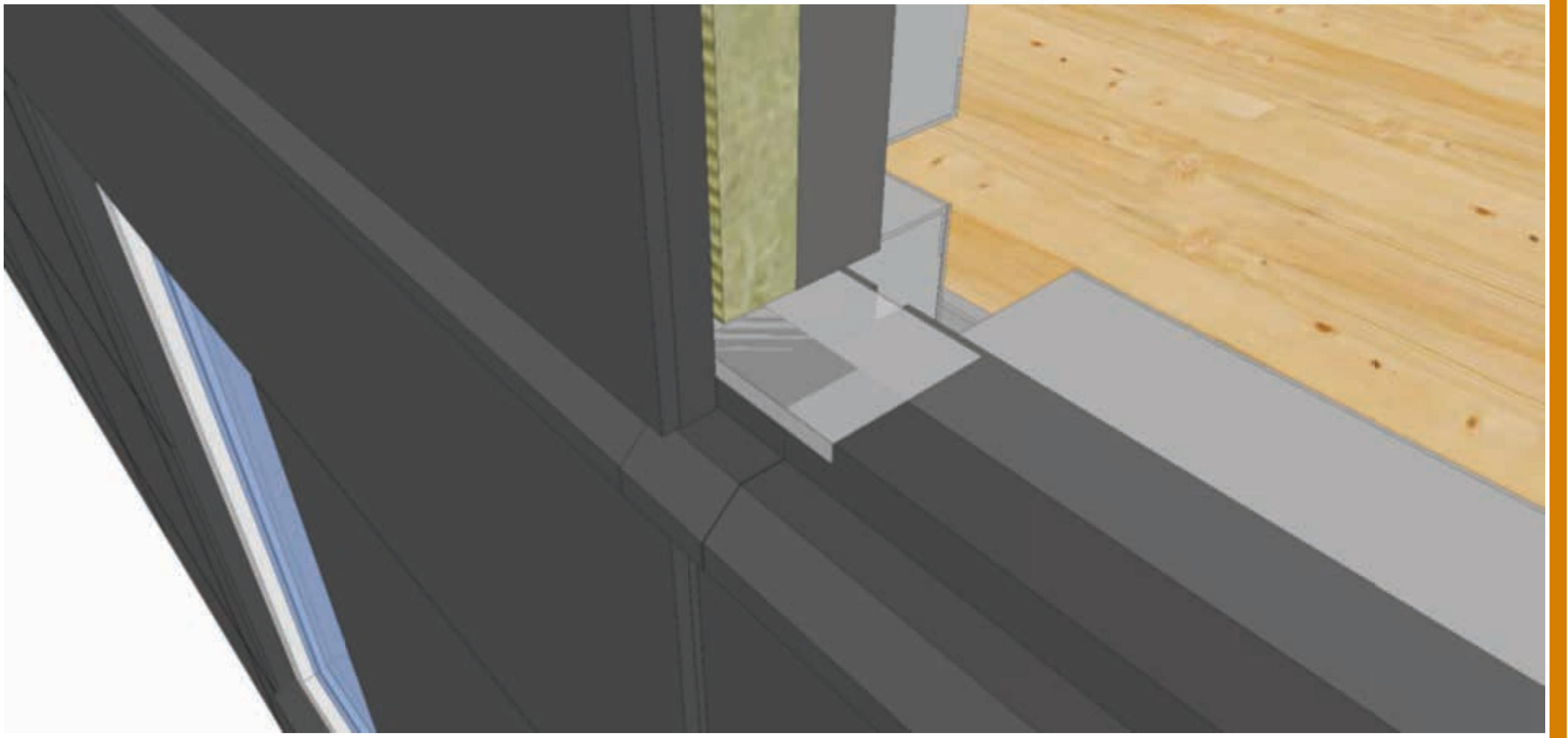
Unitized Curtain Wall Option
Problem: Cost, Schedule, Energy

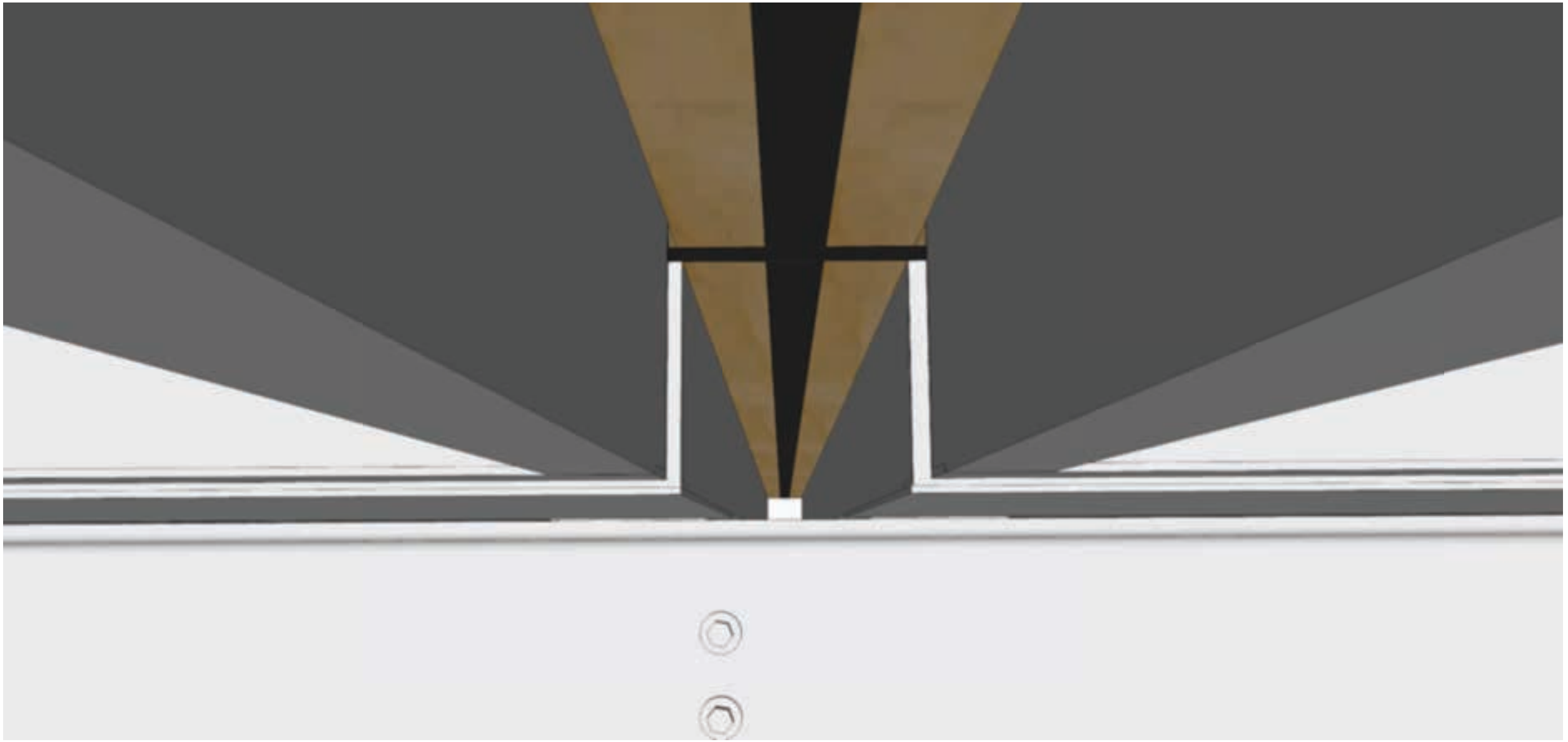
Small Panel Prefabrication Wall – Precedents
Problem: Schedule

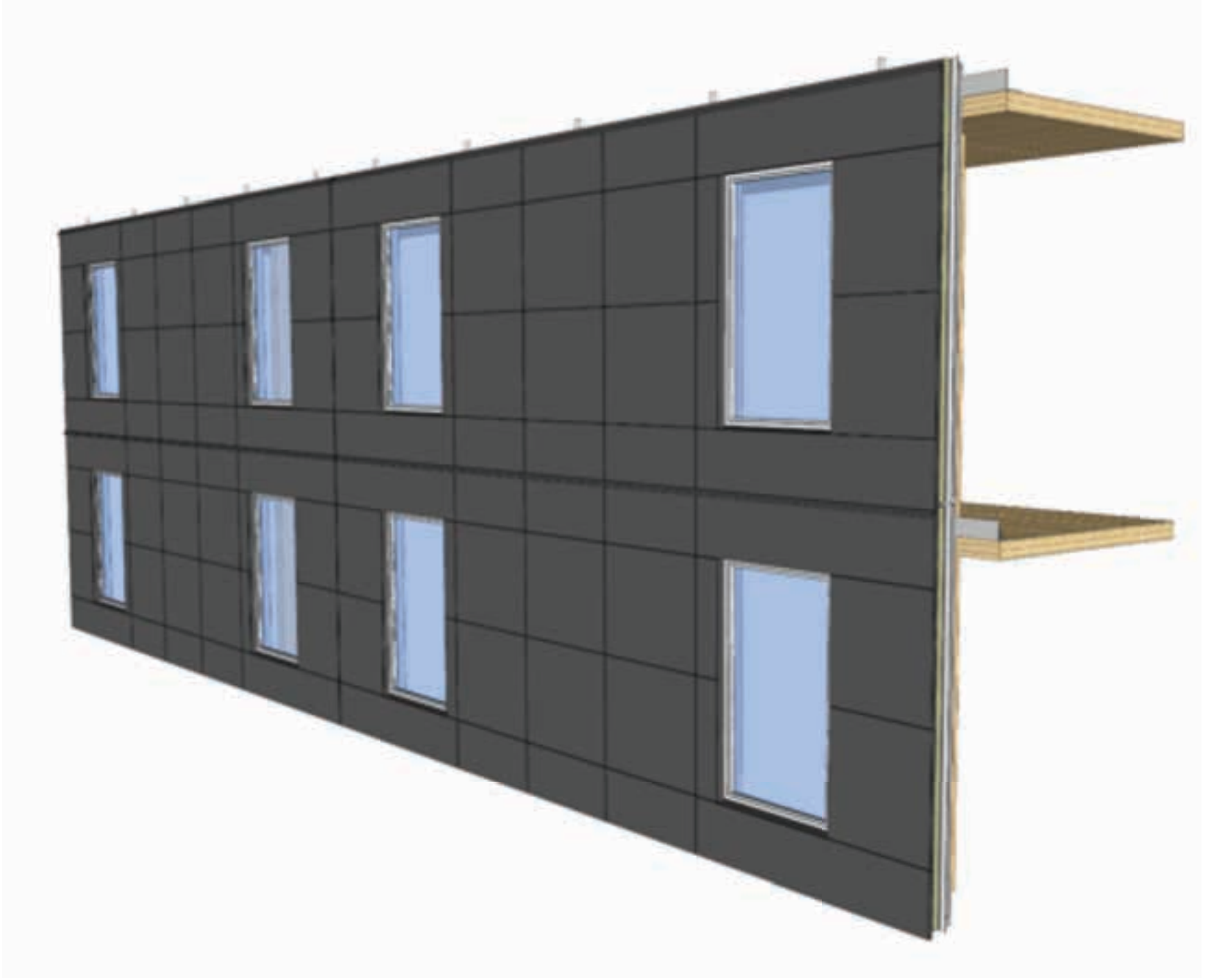
Tall Wood Prefabrication Option – Large Panel with Pre-installed Windows



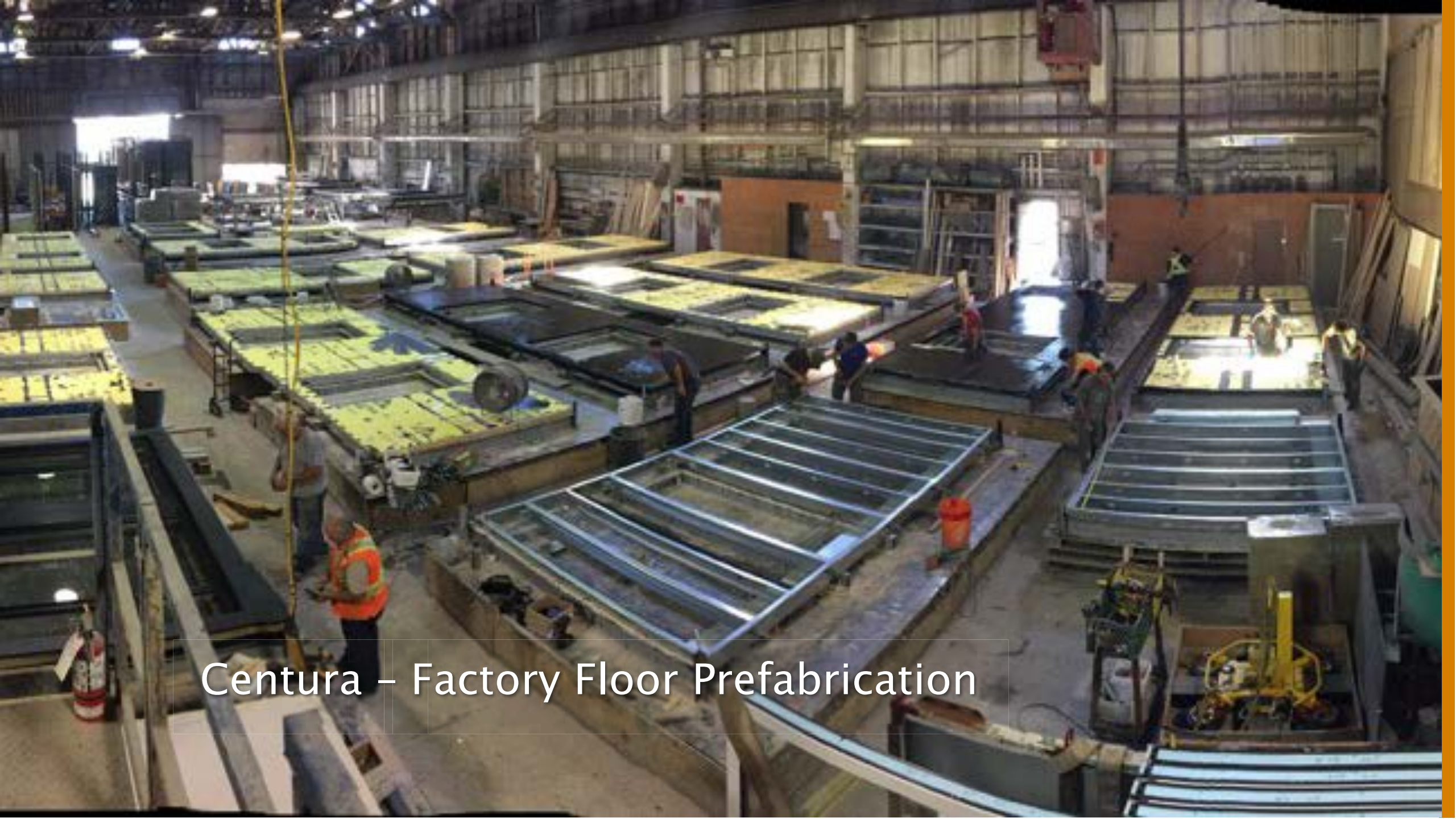








Laboratory Mockup & Physical Testing


Centura – Factory Floor Prefabrication


Site Installation – at Pace with Structure – 1 floors/day

WEEK: 1

TIMELAPSE

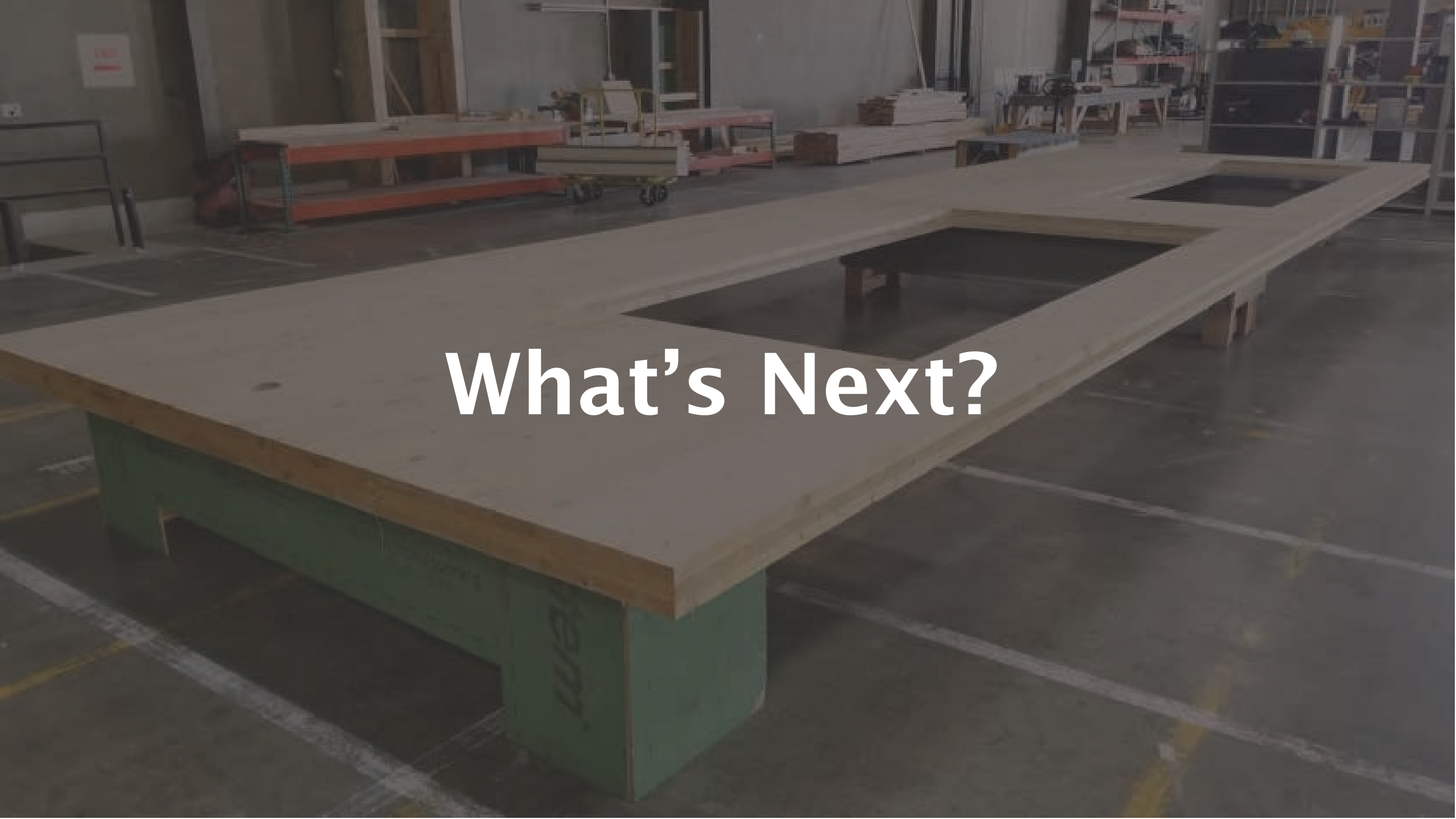
UBC
BROCK COMMONS

WOOD
CONSTRUCTION

STARTS

JUNE/6

WOOD


What’s Next?

Discussion + Questions

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Learn more at
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This concludes the American Institute of Architects Continuing Education System Course