The Rise of Modular Construction in the US: Moisture Management

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RDH

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.

The Building Enclosure

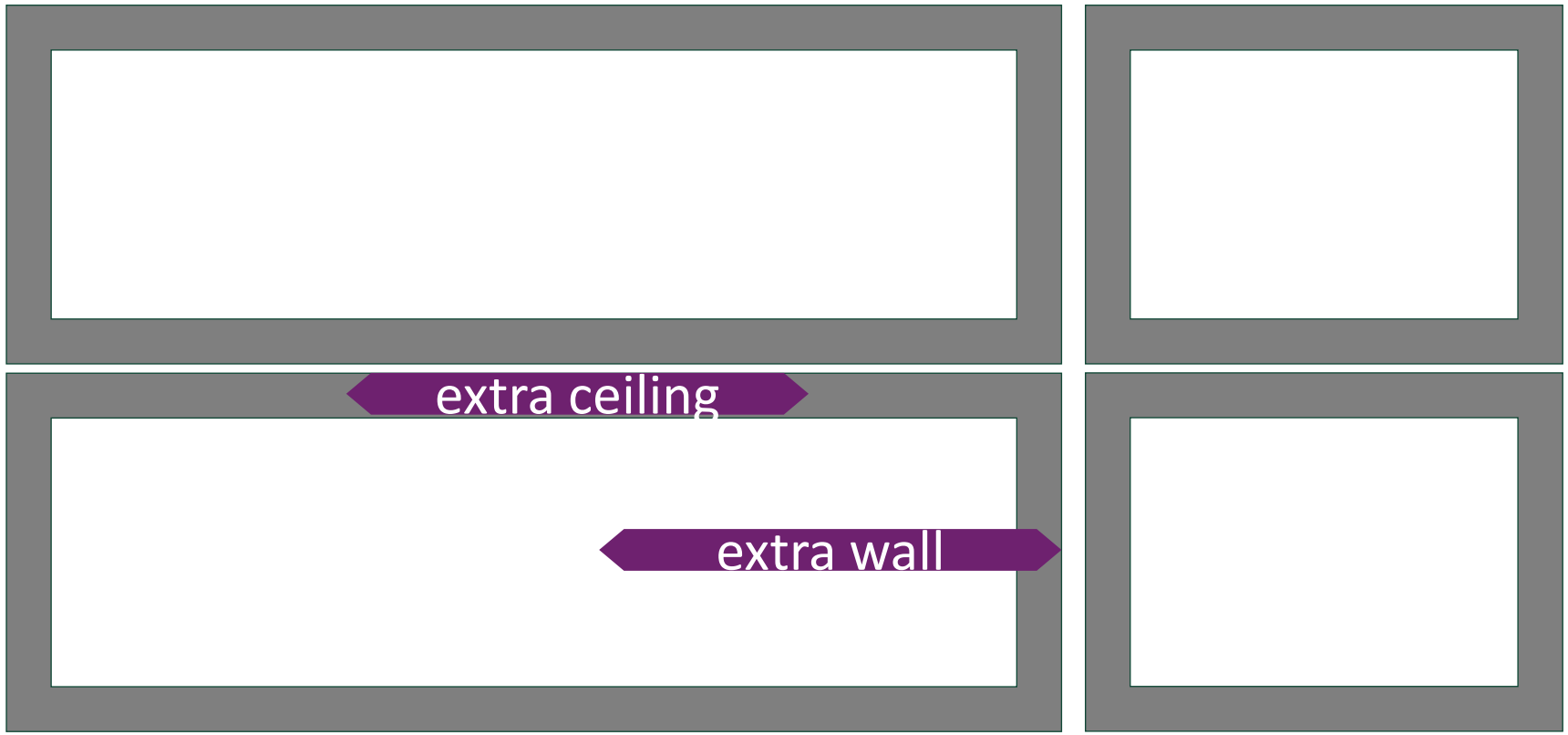
Separates indoors from outdoors by controlling:

- Water penetration
- Air flow
- Vapor diffusion (wetting & drying)
- Heat flow
- Light/solar radiation
- Noise, fire, smoke

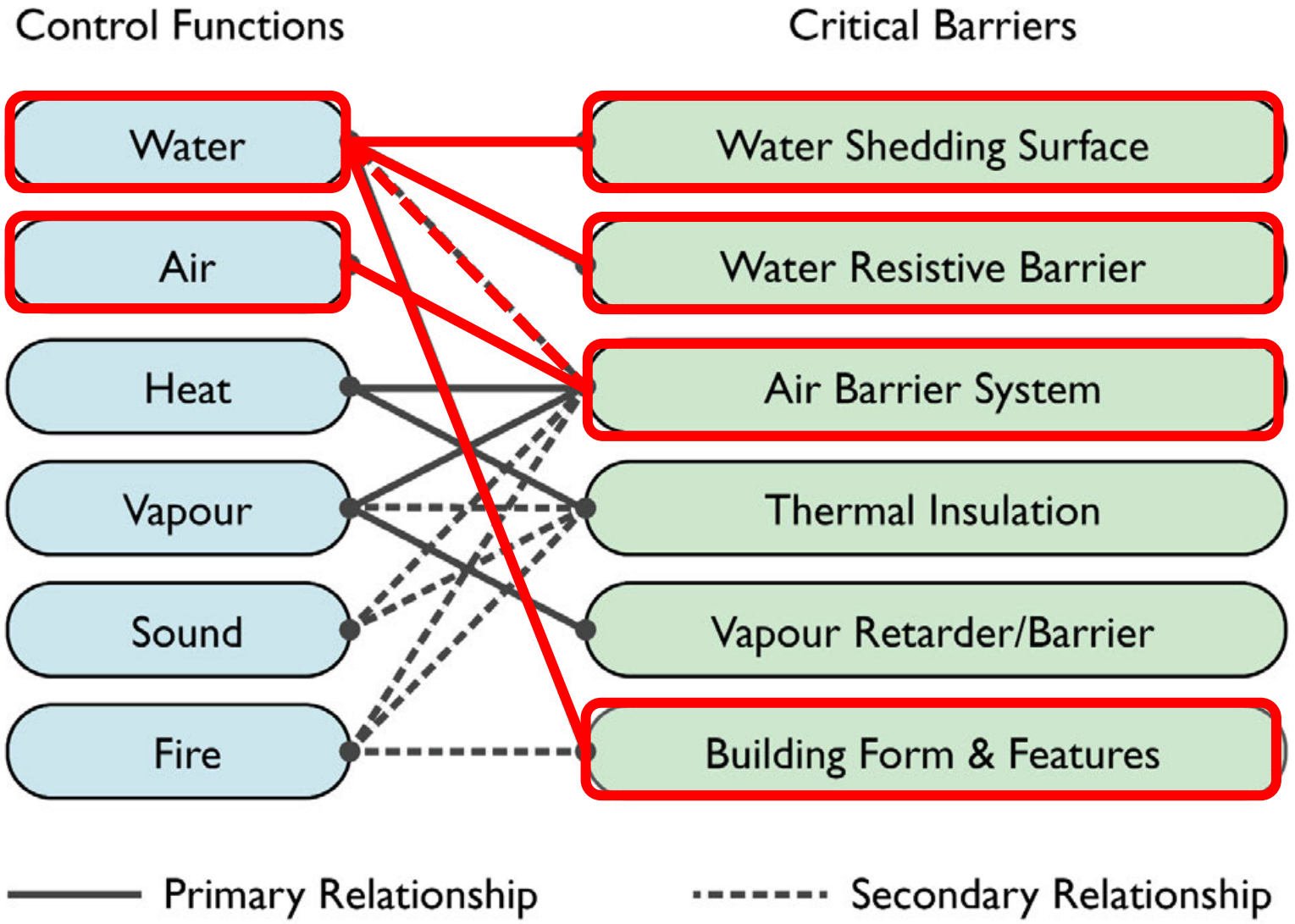
While at the same time:

- Transfer structural loads
- Be durable and maintainable
- Be economical and constructible
- Look good!

Modular Introduces Extra “Enclosure”



Modular Challenges



More Stages to Consider Explicitly

1. Storage in factory yard
2. Transport (storage to truck)
3. Storage on site
4. Setting
5. Construction
6. In-service

What Could Go Wrong?

Temp Roofing?

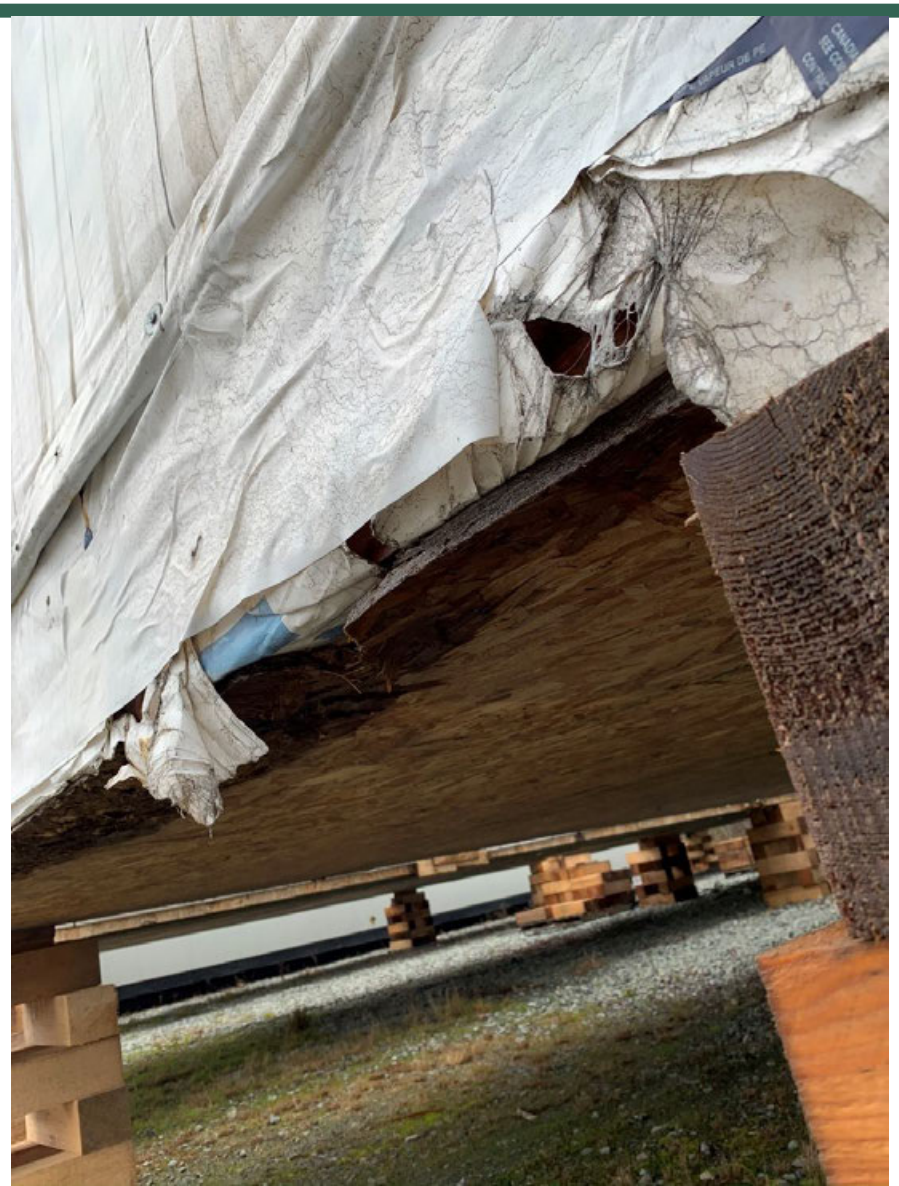
Shipping Protection

Shipping Protection

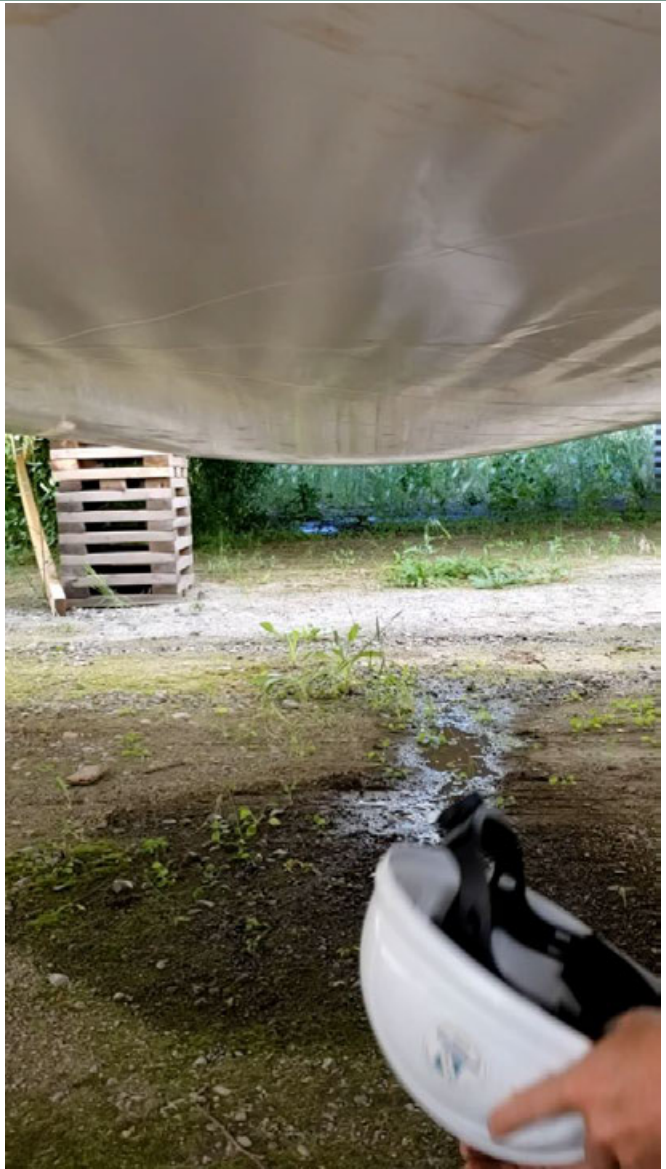
Shipping Protection

Shipping Protection

Trucking in the Rain



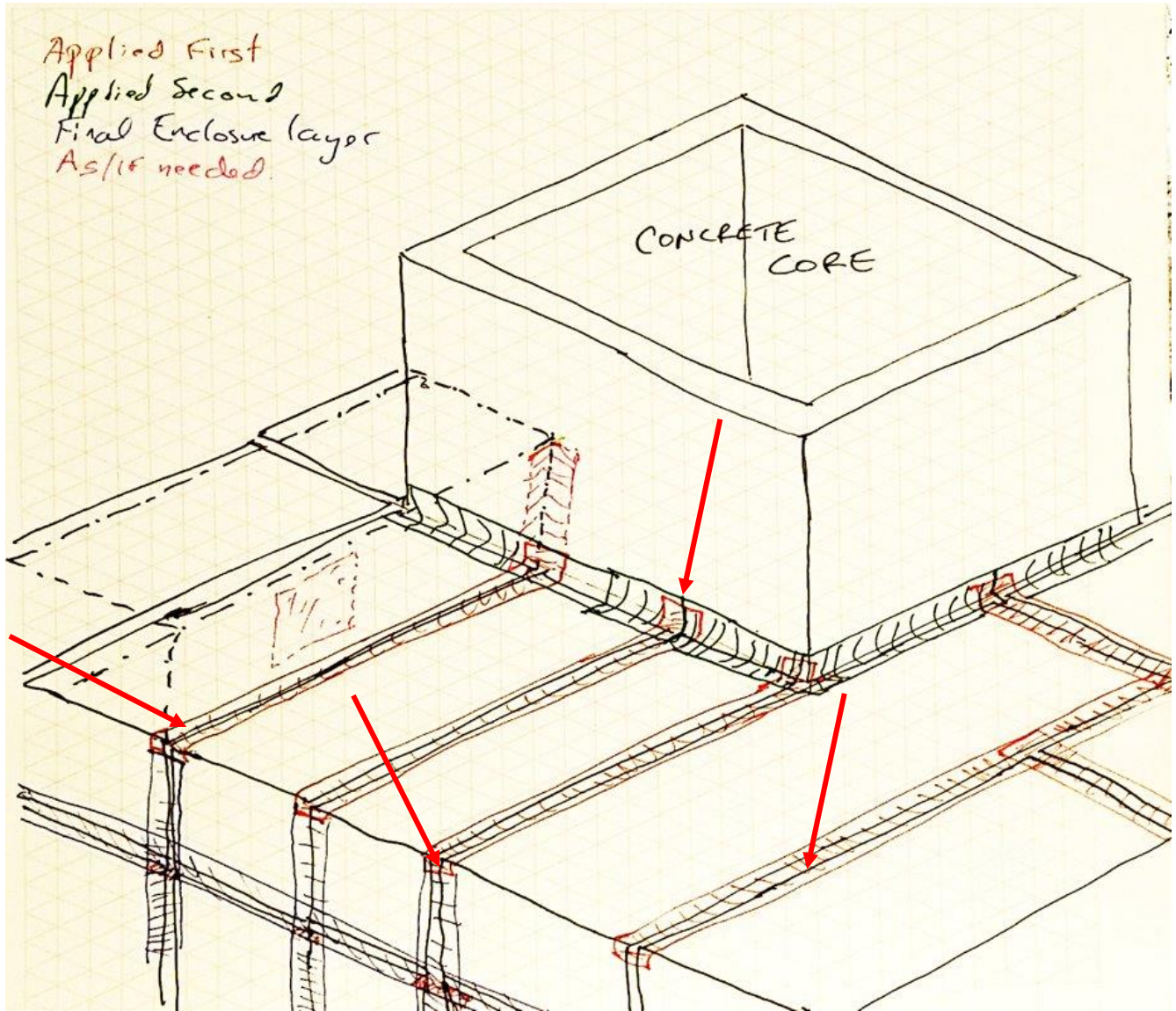
Drainage?

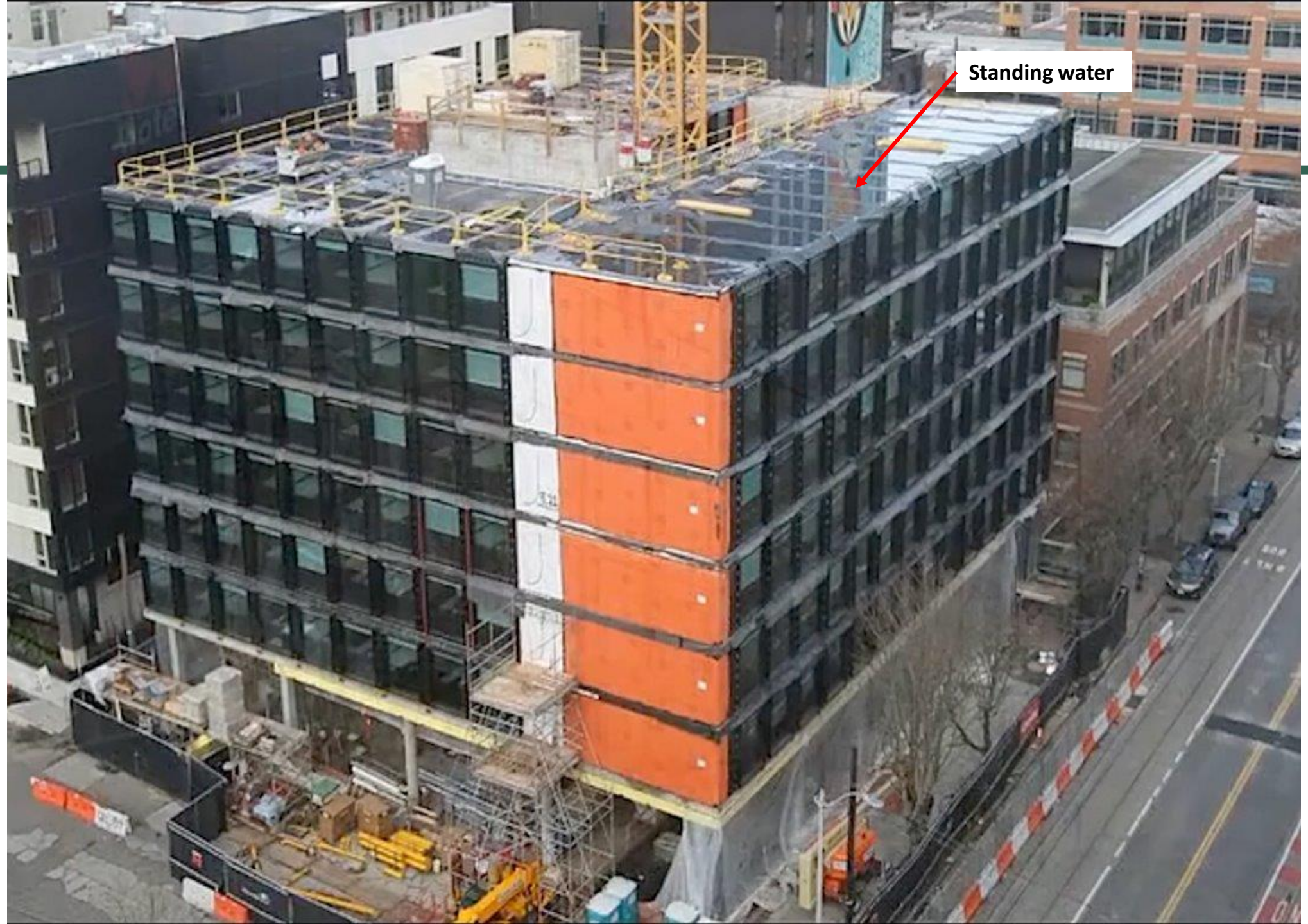


Drainage?

Larger modular - Complex

Lifting point




Standing water

Moisture Protection Keys

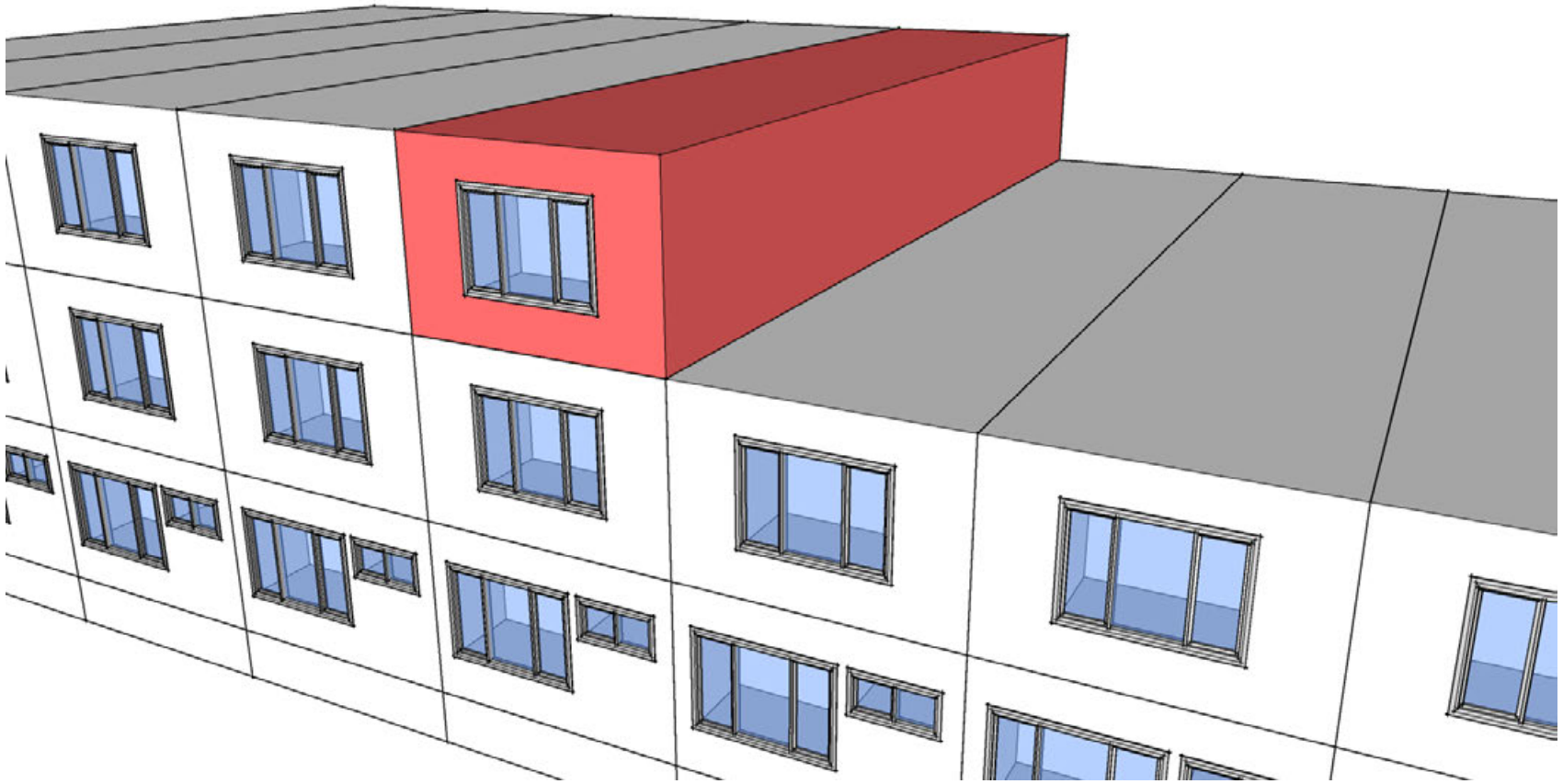
1. Wrap all 6 sides of modules with fully adhered membrane

2. Use roofing grade membrane on top of modules

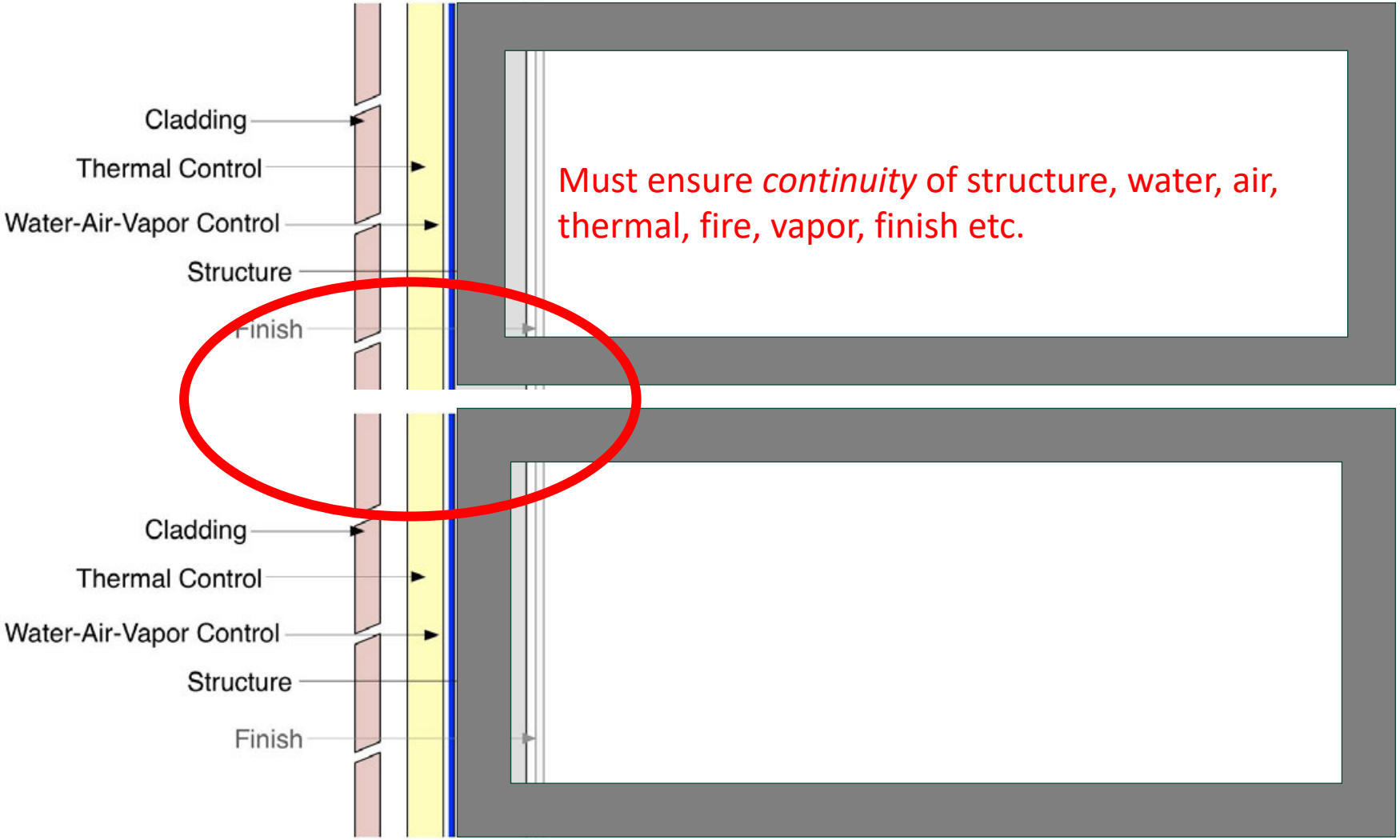
3. Check for damage daily during transport, and after every movement of the module

4. Need a detailed moisture protection plan at each stage

Joint Design



Joint Design



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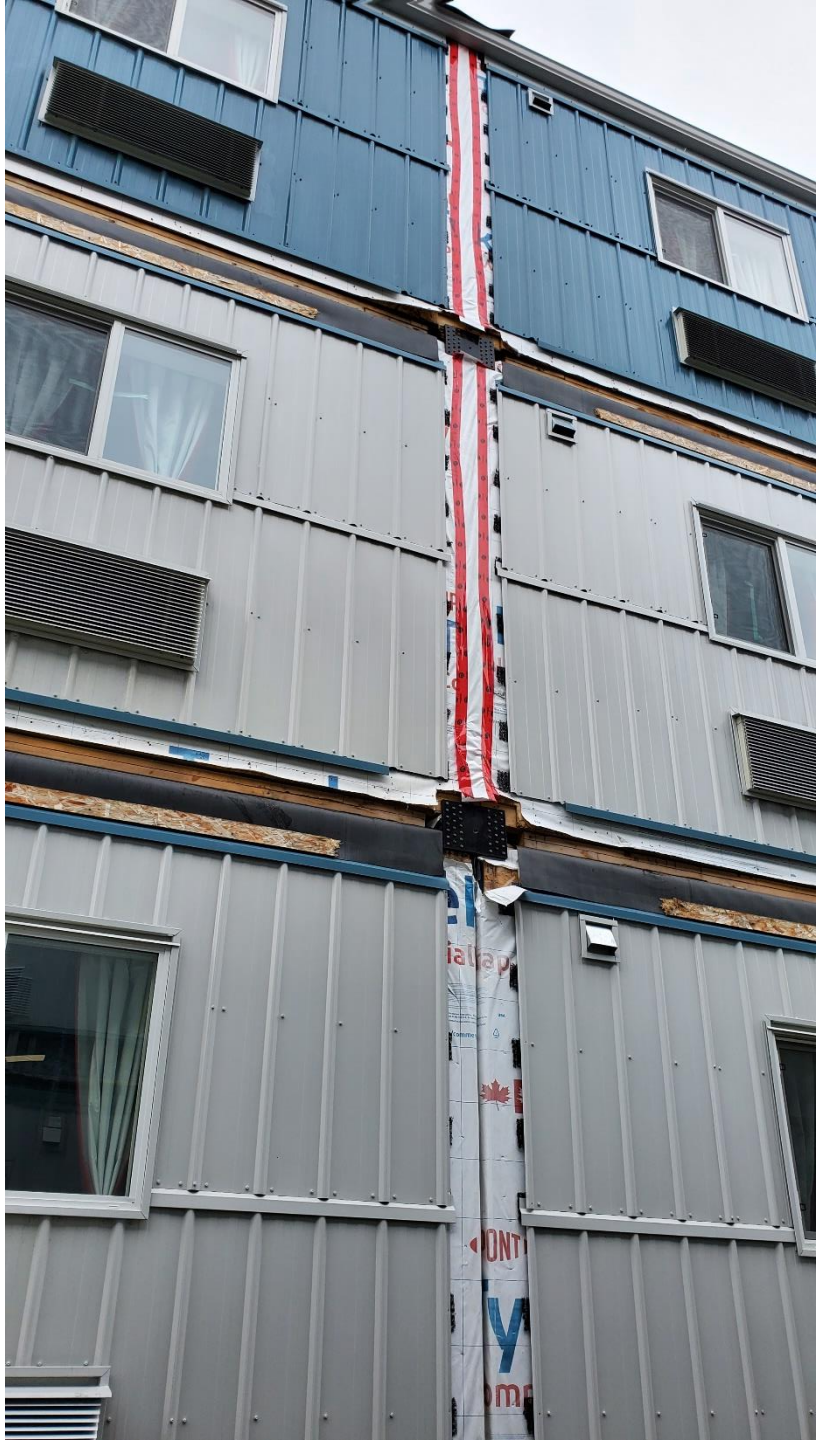



HG
T29183
T24183
DUPONT
Tyvek
SOPREMA
colphene

Joint Design

1. Need to think about what is done in factory vs on site
2. Design for adjustability to accommodate tolerances
3. Consider weather conditions during site work
4. Coordination with structural attachment

Case Study – Bella Bella

Project Overview

Owner/Operator:
Vancouver Coastal Health

Building type:
6-unit staff accommodations

Location:
Bella Bella, BC

Construction year:
2015

Designer/Manufacturer/Builder:
Mobius Architecture/Metric Modular (formerly Britco)/Spani Developments

Energy Target:
Passive House

Challenges

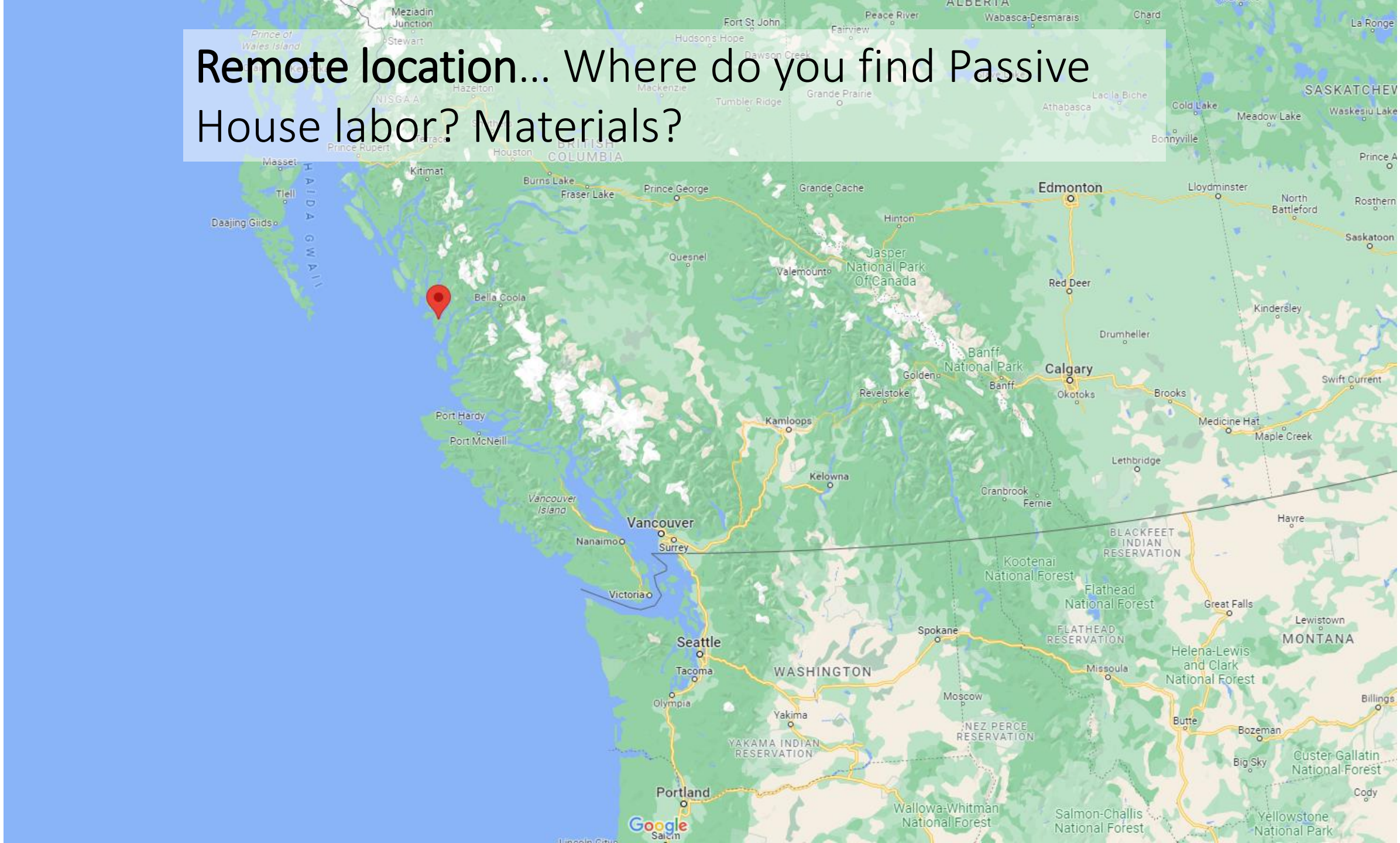
6-month timeline

Wet coastal climate with barge only access

Remote site with limited materials and local labor

First Passive House project for the design, modular, and construction team

Remote location… Where do you find Passive House labor? Materials?



Solution: Volumetric Modular Construction

Building Enclosure Design Challenges

Passive house R-values (R-35, R-100, R-80) & very good air-sealing (0.6 ACH50)

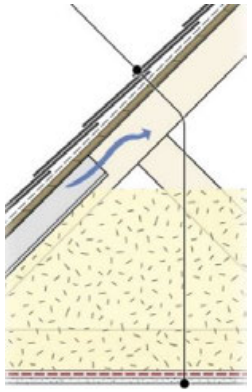
Rapid design time – needed proven assemblies and simple trainable details

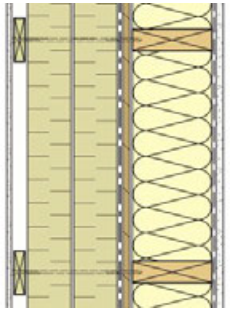
Was the first “higher-performance” building enclosure for this wood-frame modular building manufacturer

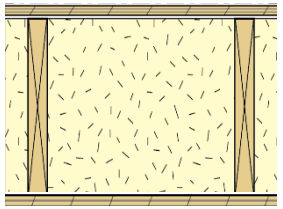
→ Materials, assemblies and details had to work within existing factory line

Had to be cost effective to fit the tight budget

Very wet climate





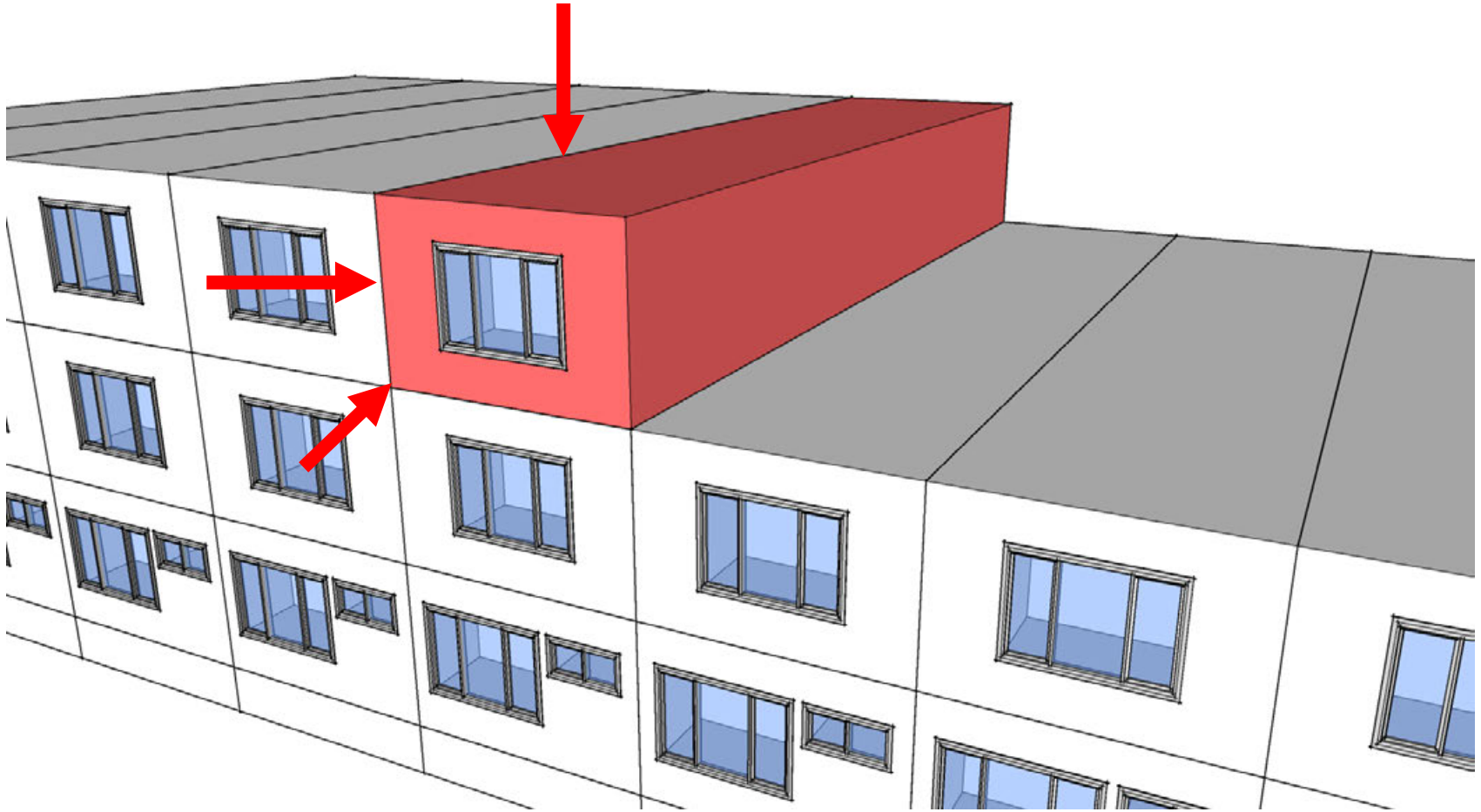


Scaling Up: Standard Wood-frame with a Self-Adhered AB/WRB & Insulation “Jacket”


Train the Trades in the Factory on New Higher Performance Building Techniques
STICK VP
soprasEAL
STICK VP

Mid-construction Air Barrier Commissioning of Each Separate Module in Factory

Modular Joints & Site Sealing

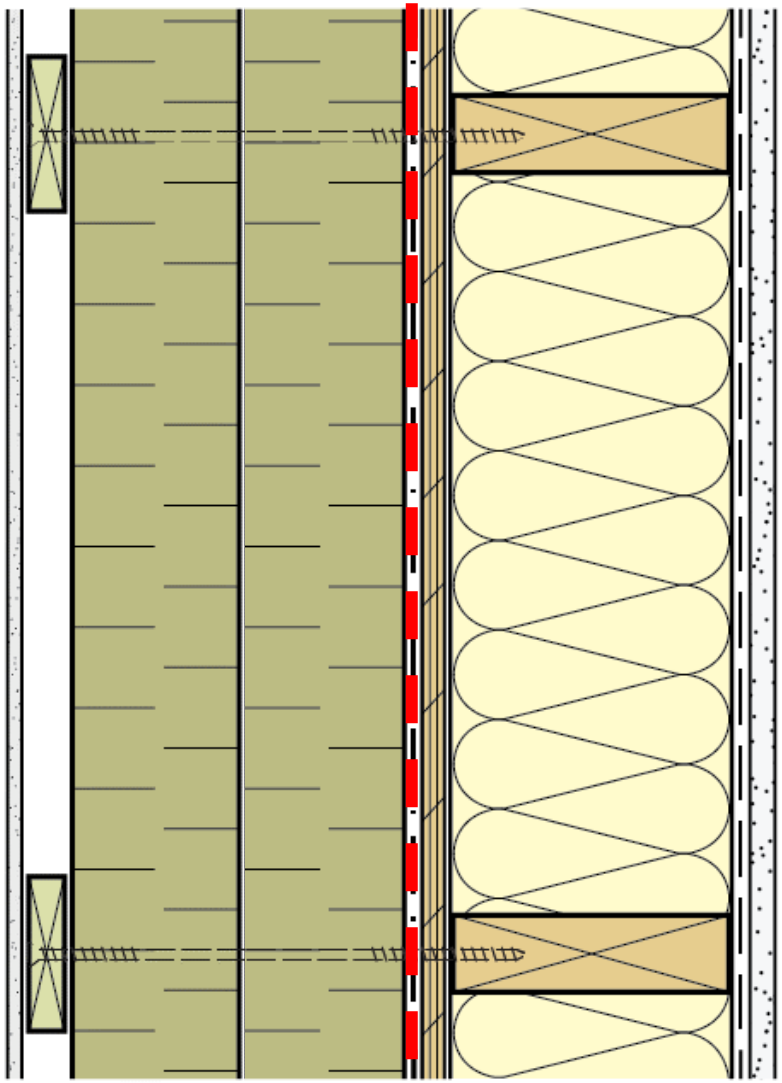


Modular Wall Joints

2x6 framing with 6” exterior insulation

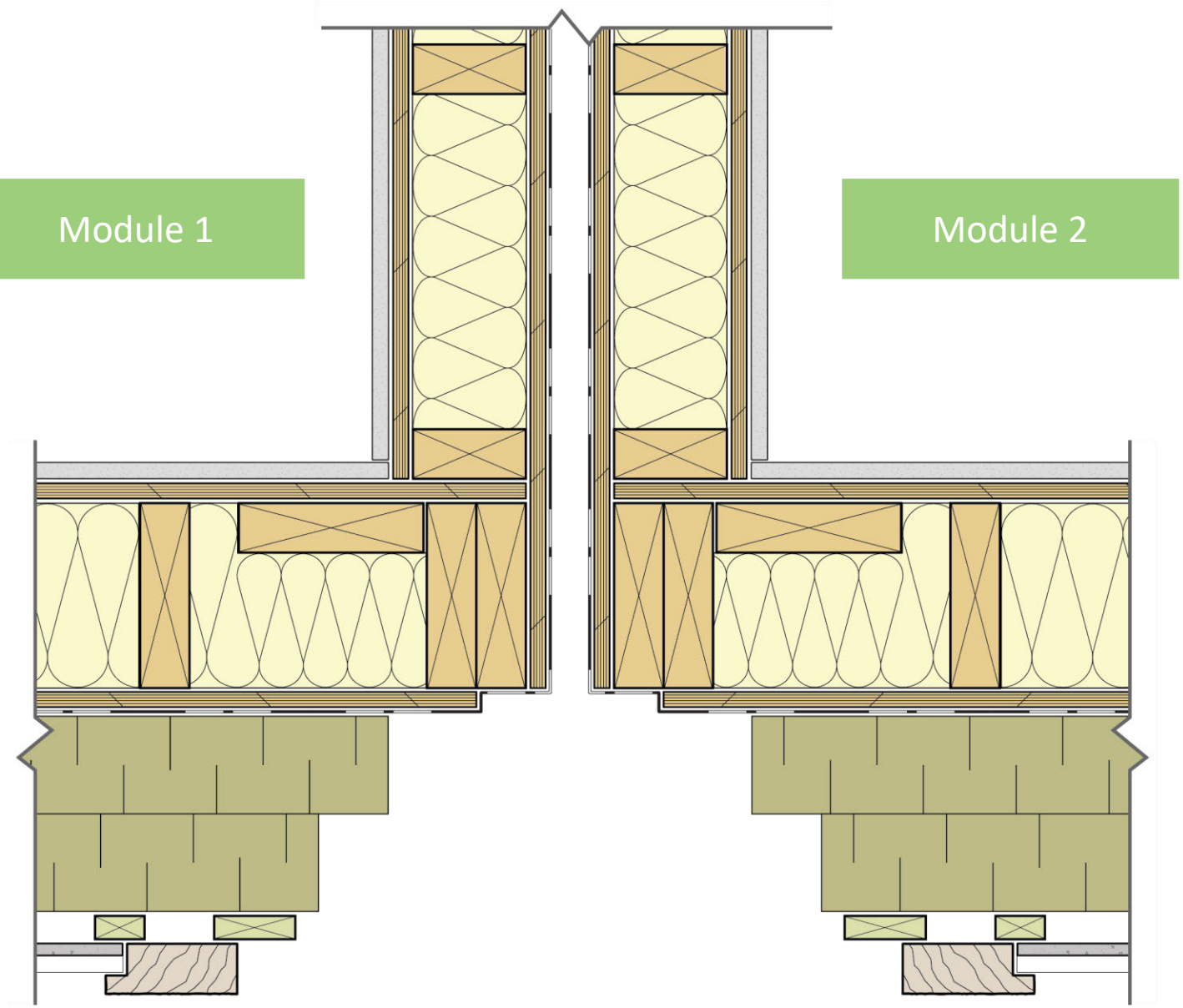
Self-adhered air and water resistive barrier at the sheathing plane behind insulation in middle of assembly

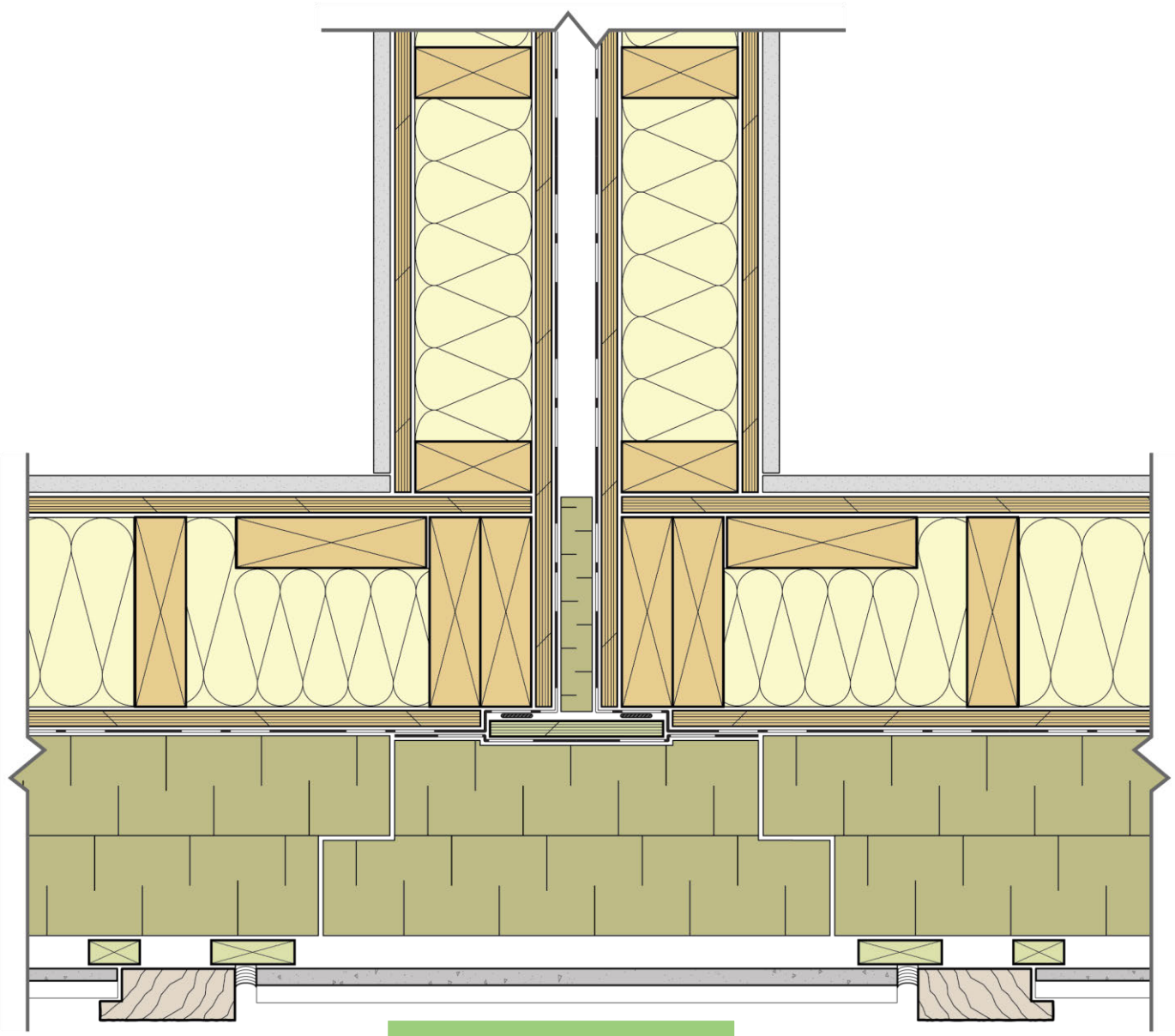
- Need to access connection onsite but want to finish as much in the factory as possible…



Module 1

Module 2





Site work


FEATHERLITE


Everything including the kitchen sink… and all the utensils

Shipping by ocean demands robust water protection on all sides

Foundation and site prep work during manufacturing & shipping


SOPREMA
STICK VP
sopraSEAL

Final Thoughts

1. Wrap all 6 sides of modules and use roofing grade products for temp roofs.

2. Need to have a moisture management plan (and follow it!). Think through what steps need to be taken at each stage.

3. In-factory and field QA/QC is critical. Mock-ups and testing in the factory prior to full production. Very expensive to fix factory errors in the field.

4. Tolerances and structural attachment must be considered and coordinated with enclosure detailing. Needs to be a collaborative design process.

5. Design has to be thoroughly vetted. Very difficult to change once production starts.

QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

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