

Detailing Deep and Double Stud Walls

CHBA Net Zero Webinar Series - 3 of 3

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Webinar Series

Building Science for Net Zero Energy Wood-frame Walls:

1. Exterior Insulation Selection
2. Detailing with Exterior Insulation
3. Detailing with Deep & Double Stud Walls

The logo for RDH, consisting of the letters 'RDH' in a bold, sans-serif font. The 'R' is blue, the 'D' is orange, and the 'H' is blue.

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Goal Today:

Understand building science principles and observe examples of the detailing of *deep stud* and *double stud* wall assemblies

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Webinar #3

Double Stud & Deep Stud Wall Systems

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Air & Vapour Control & Alternate Materials/Methods

↓

Case Studies, Research & Detailing Examples

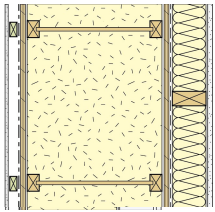
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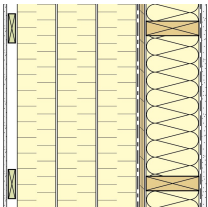
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High R-value Wood-frame Walls – 2 Fundamental Approaches

Stuff It: Deep/Double Stud



Wrap It: Exterior Insulated

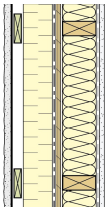
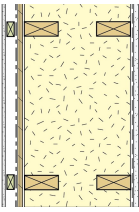









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Deep/Double Stud vs Exterior Insulated Walls

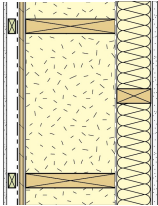
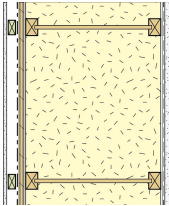
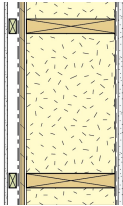
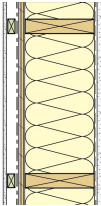
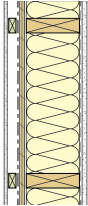


Cost Efficiency / Affordability	 <div>★ ★ ★ ★ ★</div>	Cheaper materials, more labour?
Constructability & Detailing	 <div>★ ★ ★ ★ ★</div>	May be easier for some trades
Performance (R-value/Airtightness)	 <div>★ ★ ★ ★ ★</div>	Thicker for same R-value, Similar airtightness with good details
Moisture Durability & Resilience	 <div>★ ★ ★ ★ ★</div>	Higher moisture risk to manage
Sustainability & Material Selection	 <div>★ ★ ★ ★ ★</div>	Possibly better

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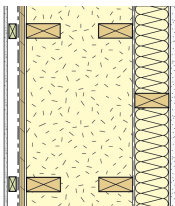
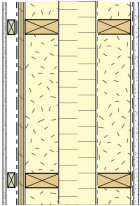
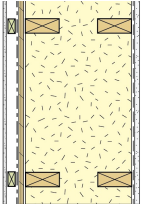
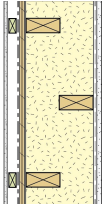
Deep Stud, Double Stud, What Stud?



Standard (2x4/2x6)

Deep Studs (2x8/2x10/2x12/ I-joist)

Deep Stud+ Service Wall



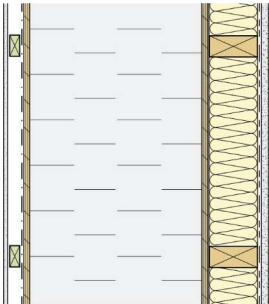
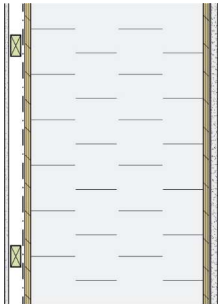
Double Stud - Staggered

Double Stud

Double Stud+ Service Wall (Triple Stud)

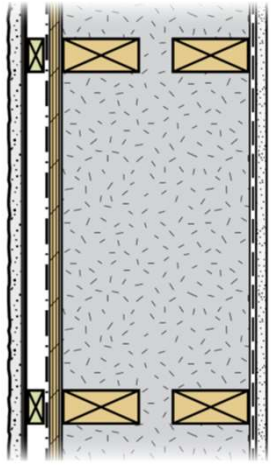
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Stud Wall Variants: SIPs



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Effective R-values – Double Stud Walls



Effective Assembly R-value for Double 2x4 Stud Wall* [ft²·°F·hr/Btu]			
Thickness of Gap Between Stud Walls	R-value/inch of Insulation		
	R-3.4	R-4.0	R-5.0
0"	19.7	21.2	23.3
1/4"	20.5	22.2	24.5
1/2"	21.4	23.2	25.8
1"	23.1	25.2	28.3
1 1/2"	24.8	27.2	30.8
2"	26.5	29.2	33.3
2 1/2"	28.2	31.2	35.8
3"	29.9	33.2	38.3
3 1/2"	31.6	35.2	40.8
4"	33.3	37.2	43.3
4 1/2"	35.0	39.2	45.8
5"	36.7	41.2	48.3

Assumes interior stud wall has the same 23% framing factor as the exterior stud wall, though it may require less framing.

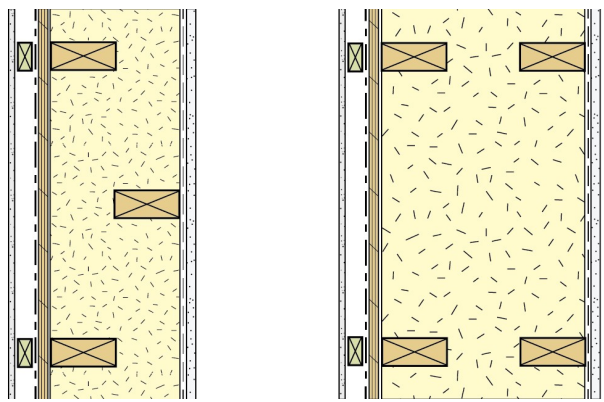
Mid R-30s to R-40s = 3 1/2" - 6" gap with fibrous insulation




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Avoid the Stagger



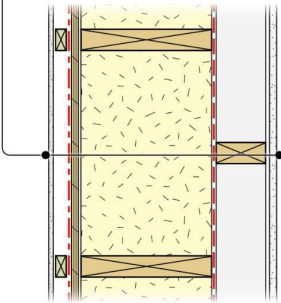
Once studs are separated by more than 1", there is almost no thermal benefit from staggering studs (and it is a pain)



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Exterior
Cladding
Strapping
Rainscreen cavity
Sheathing membrane
Exterior sheathing
Deep stud framing
Batt or blown-in insulation
Polyethylene or Taped
Sheathing
Service wall framing
Finished gypsum board
Interior



Effective R-values – Deep Stud Walls

Effective R-values | Deep Stud-Insulated Wall

Wall Framing	Uninsulated 2x4 Framed Wall			2x4 R-12 Insulated Service Wall		
	R-3.4 / inch	R-4 / inch	R-5 / inch	R-3.4 / inch	R-4 / inch	R-5 / inch
2x6	17.2	18.3	19.9	24.7	25.8	27.4
2x8	21.4	22.9	25.0	28.9	30.4	32.5
2x10	26.3	28.1	30.9	33.8	35.6	38.4
2x12	31.1	33.3	36.6	38.6	40.8	44.1
9.5" I-Joist	26.9	28.8	31.6	34.4	36.2	39.1
11.9" I-Joist	32.7	35.1	38.6	40.2	42.6	46.1
14" I-Joist	37.9	40.7	44.8	45.4	48.2	52.3
16" I-Joist	42.7	45.8	50.6	50.2	53.3	58.1

Mid R-30s to R-40s =
>2x12 depth or >2x10
with service wall

Building Science Assembly Design Criteria

Control Functions


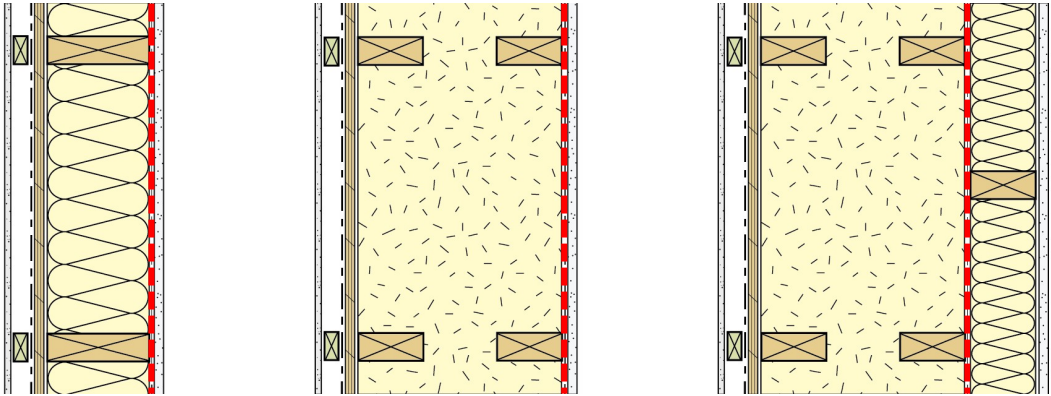
- Water
- Air
- Heat
- Vapour
- Sound
- Fire

Critical Barriers

- Water Shedding Surface
- Water Resistive Barrier
- Air Barrier System
- Thermal Insulation
- Vapour Retarder/Barrier
- Building Form & Features

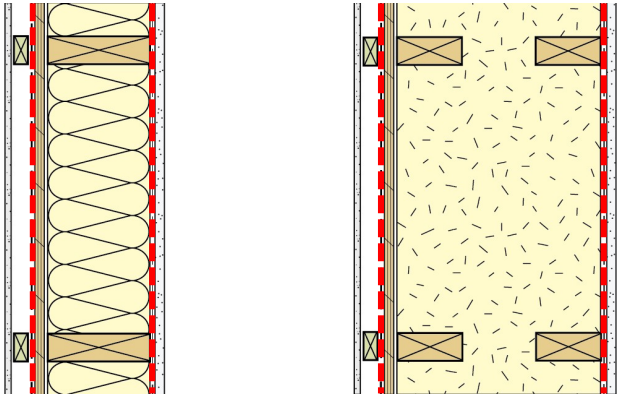
— Primary Relationship - - - - - Secondary Relationship

Vapour Barrier Placement?




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Air Barrier Placement? In vs. Out vs. Both?



?



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Why Keep Some Interior Airtightness ? Convective Looping

A: Air Loops Around Insulation

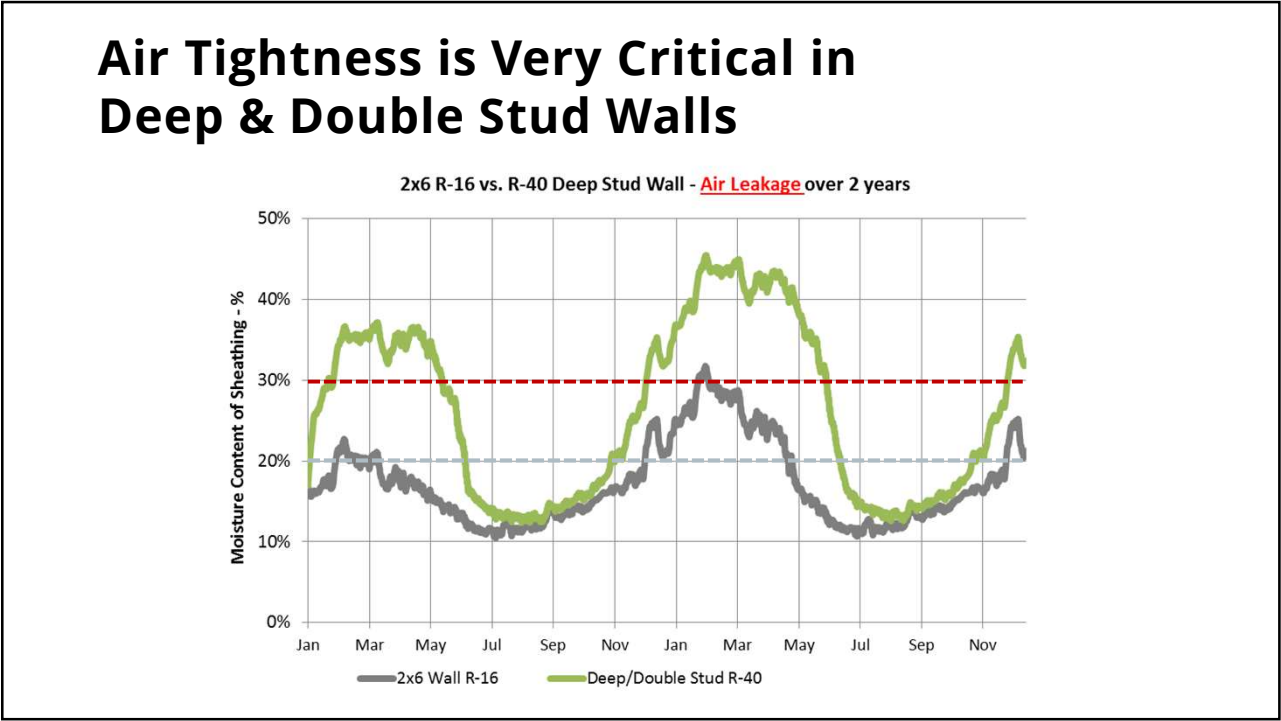
B: Air Loops Through Insulation

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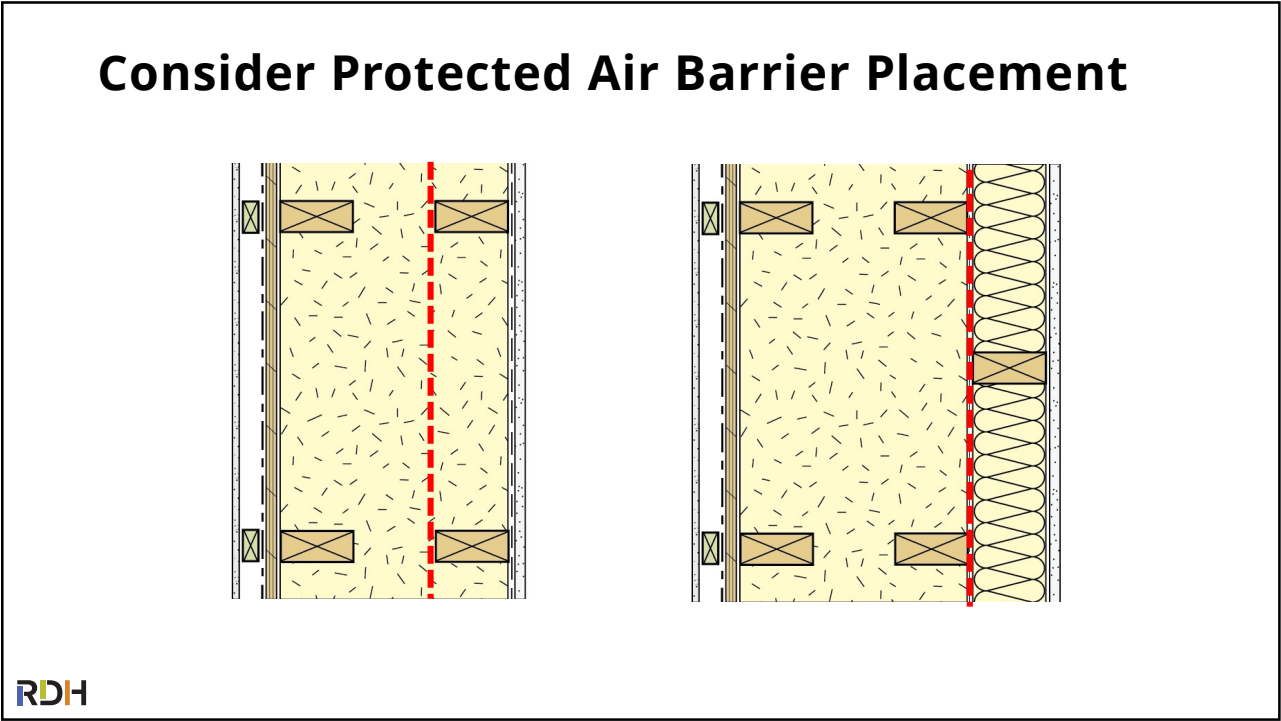
Can I Still Add an Exterior Air Barrier Too?

YES You Can!

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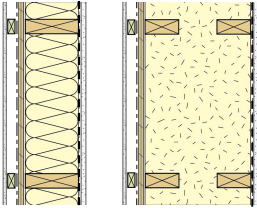


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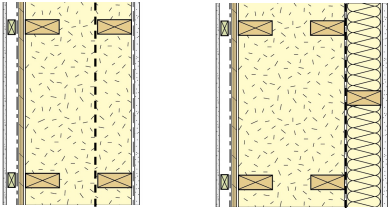


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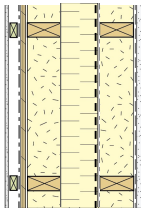
Air Barrier Placement, Materials & Service Cavities



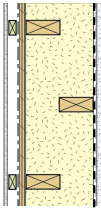
Conventional - Inside Unprotected



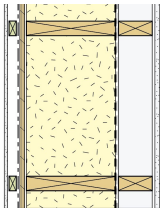
Protected Membrane or Sheathing (Service Cavity)



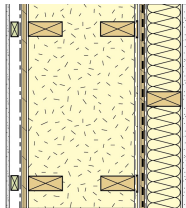
Protected (Rigid Insulation)




Protected Membrane or Sheathing (Service Cavity)



Protected Membrane or Sheathing (Service Cavity)

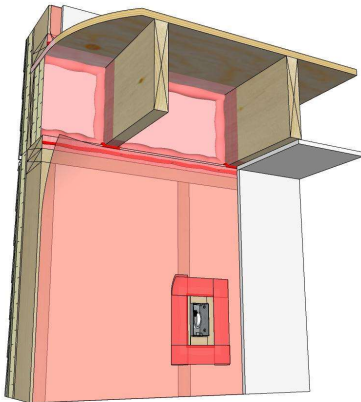


Protected Membrane or Sheathing (Service Cavity)

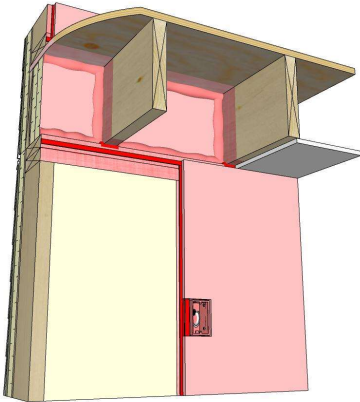


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Interior Air Barrier System Options - Deep Walls



Sealed Polyethylene or Other Membrane



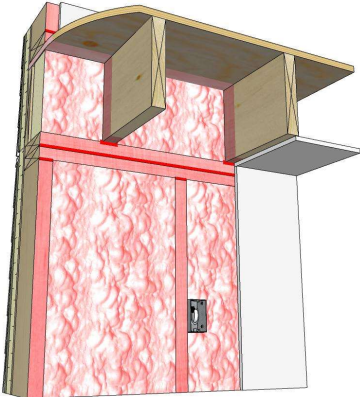
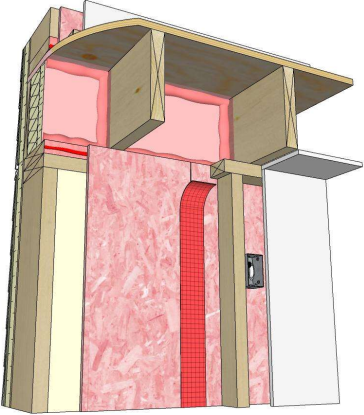
Airtight Drywall



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Interior Air Barrier System Options - Deep Walls



Sealed Rigid Sheathing
(or Rigid Foam Board)

Sprayfoam and Sealant



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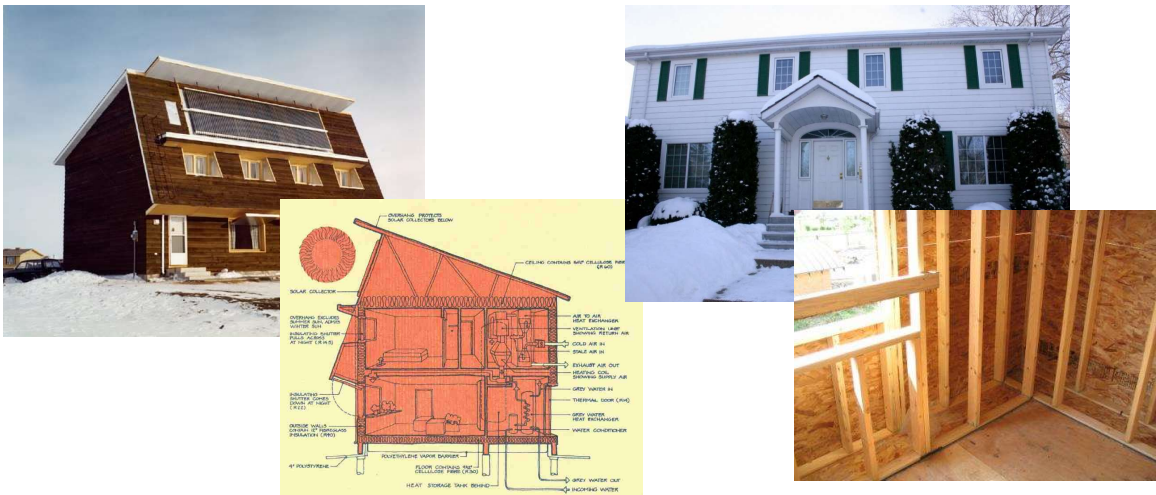
Air Barrier Materials - Interior Protected





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A Long Canadian History of Double Walls



- In 2012 FP Innovations with support of Harold Orr and Rob Dumont looked at/tested 6 homes built/retrofit with double walls between 1979 and 1992 in Saskatoon area (cold, dry climate)
- All 6 still performing well, no durability or airtightness issues (poly AB protected by inner stud)

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Example: Interior Cross Strapping



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Example: Traditional Double Stud



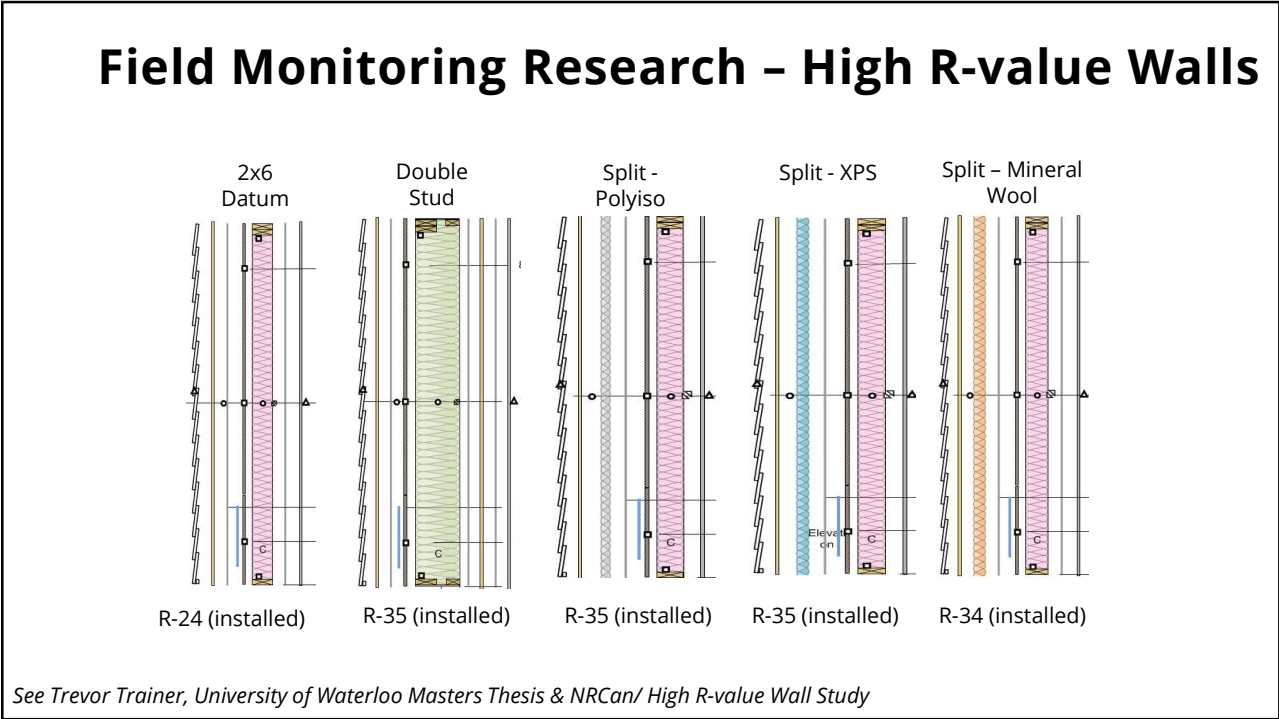
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Field Monitoring Research – High R-value Walls

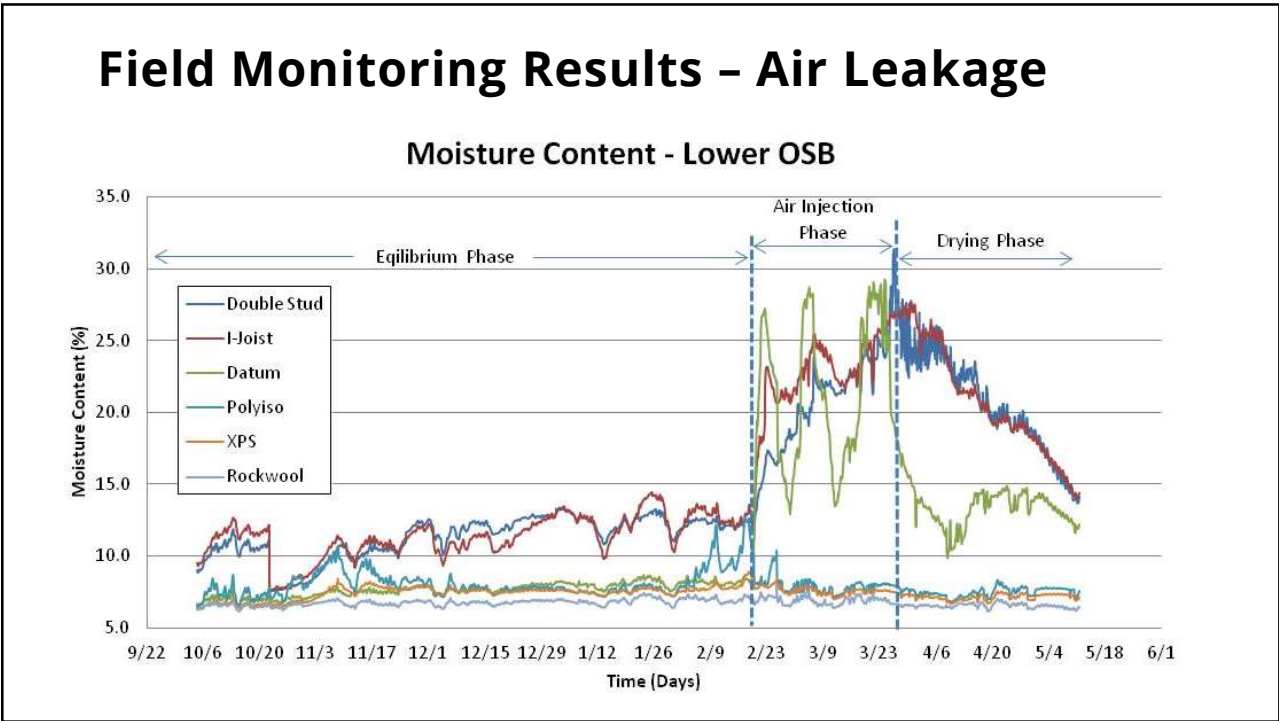


- North and south elevations were used for testing
- Natural weather exposure (Southern Ontario)
- Interior Conditions: 21 °C, 40% RH (winter)

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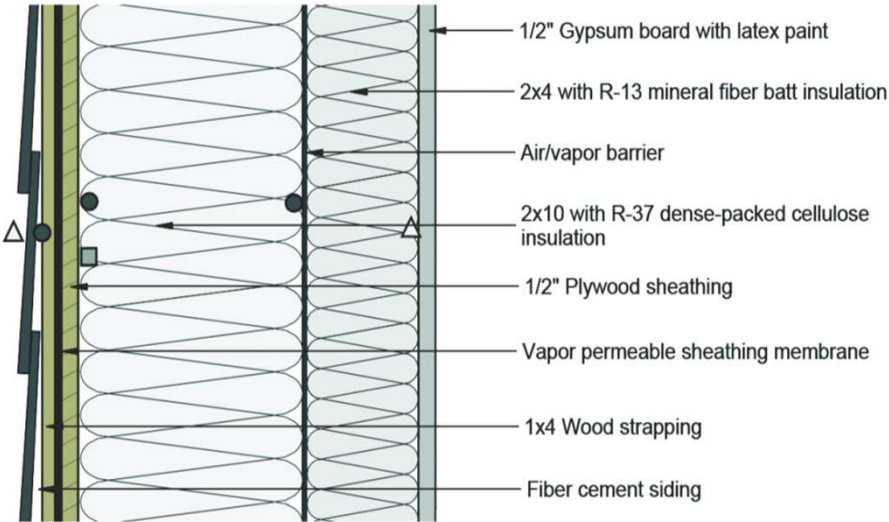


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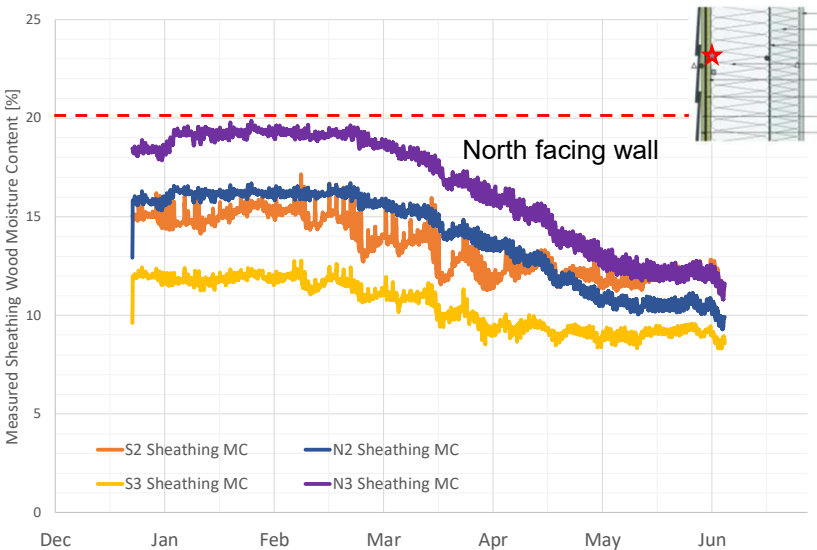

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Field Monitoring: Victoria Passive House



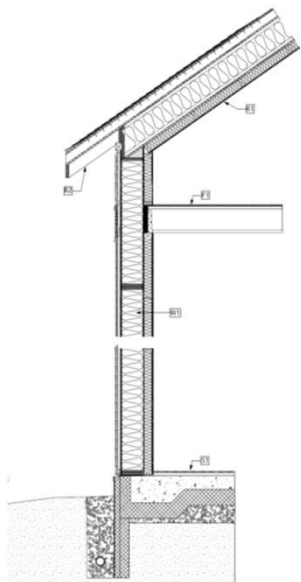
29

Field Monitoring: Victoria Passive House



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Field Monitoring: Langley Passive House

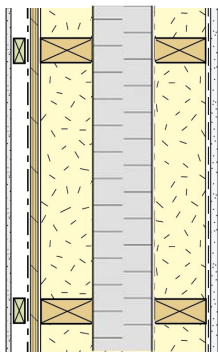


Design by: Guido Wimmers



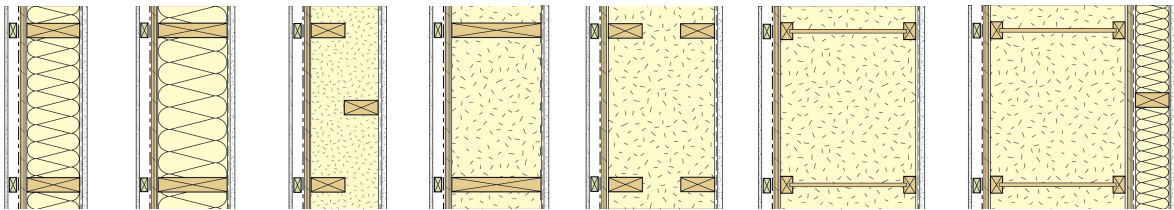
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Example: The “Ice Cream Sandwich”



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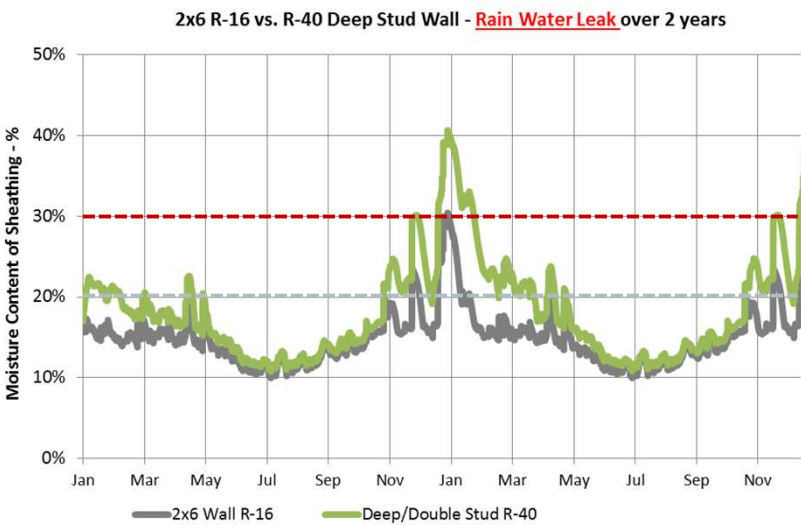
Water Management - Drained & Ventilated Rainscreen



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Why Increased Risk?



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Risk Management for Deep Stud Walls



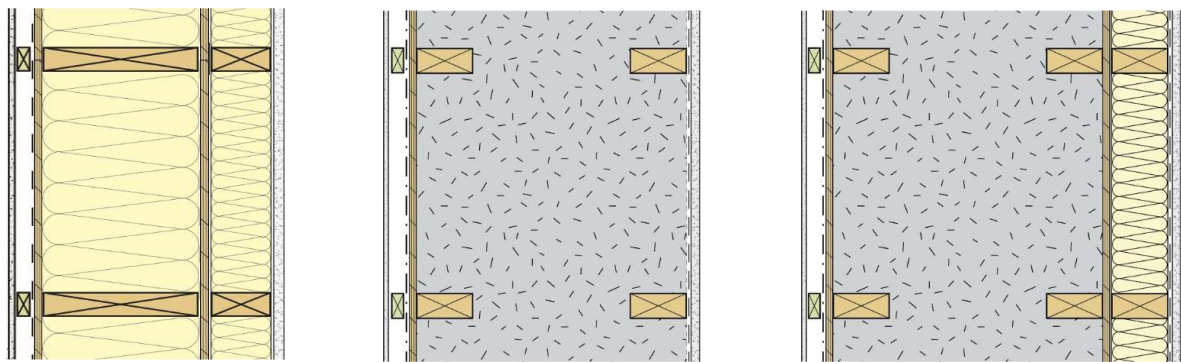
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Insulation Considerations



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Insulation Considerations – Batts vs Blown



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Densepack vs Dense Blown Cellulose

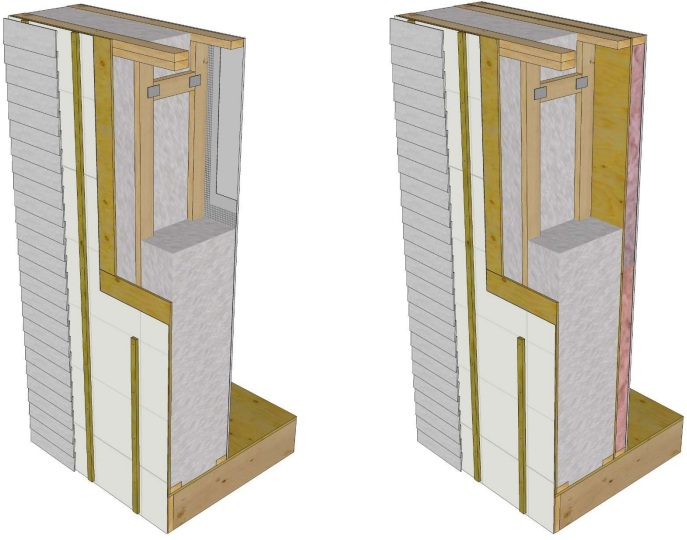


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Double Stud/Deep Stud Wall Summary

Rainscreen cladding & details for enhanced moisture risk management

Airtight Housewrap?



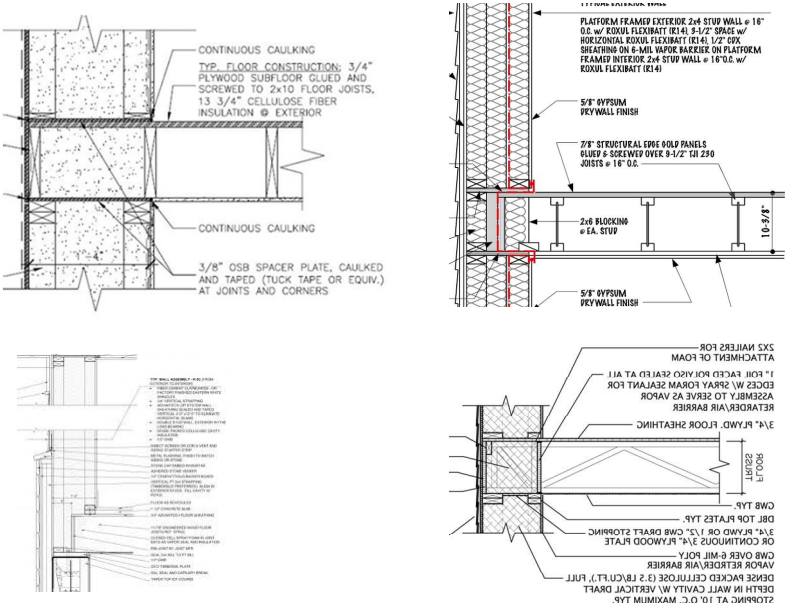
Dense fit/blown insulation

Interior Vapour Control

Interior Air Barrier (supported both sides, possibly rigid), ideally protected by service cavity (no holes in AB)

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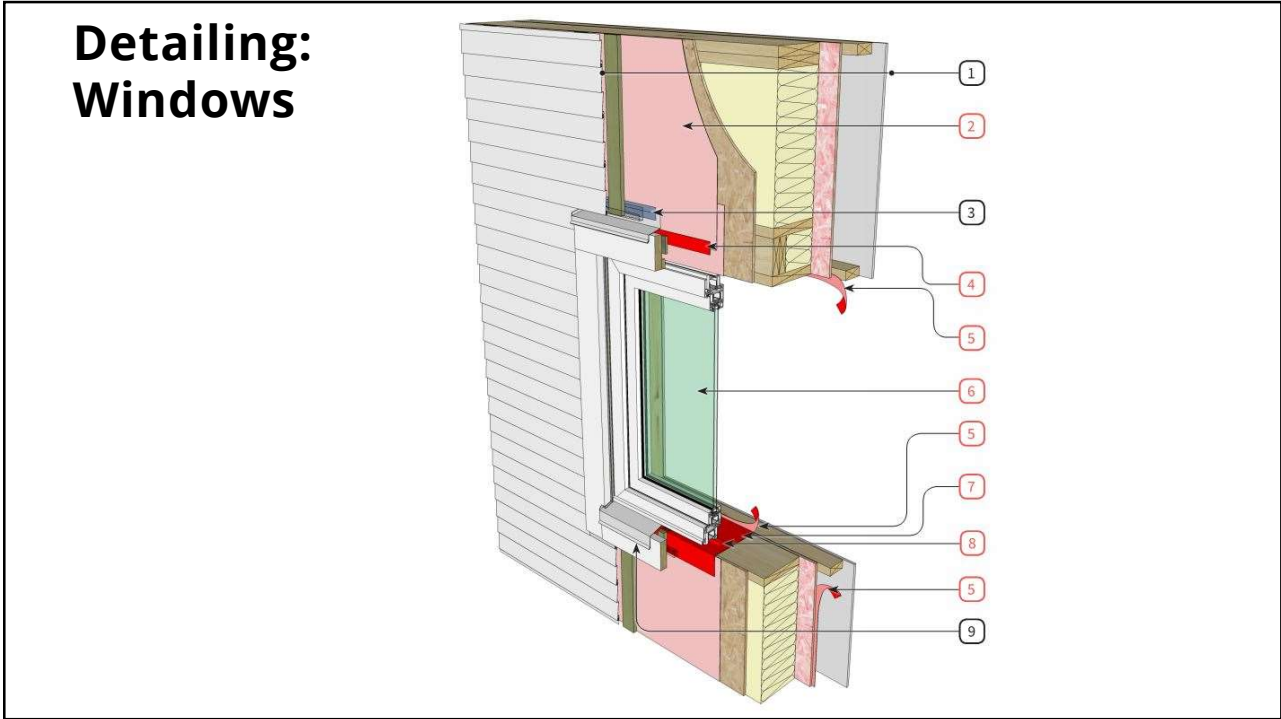
More than One Way to Frame



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G.Finch - RDH - www.rdh.com

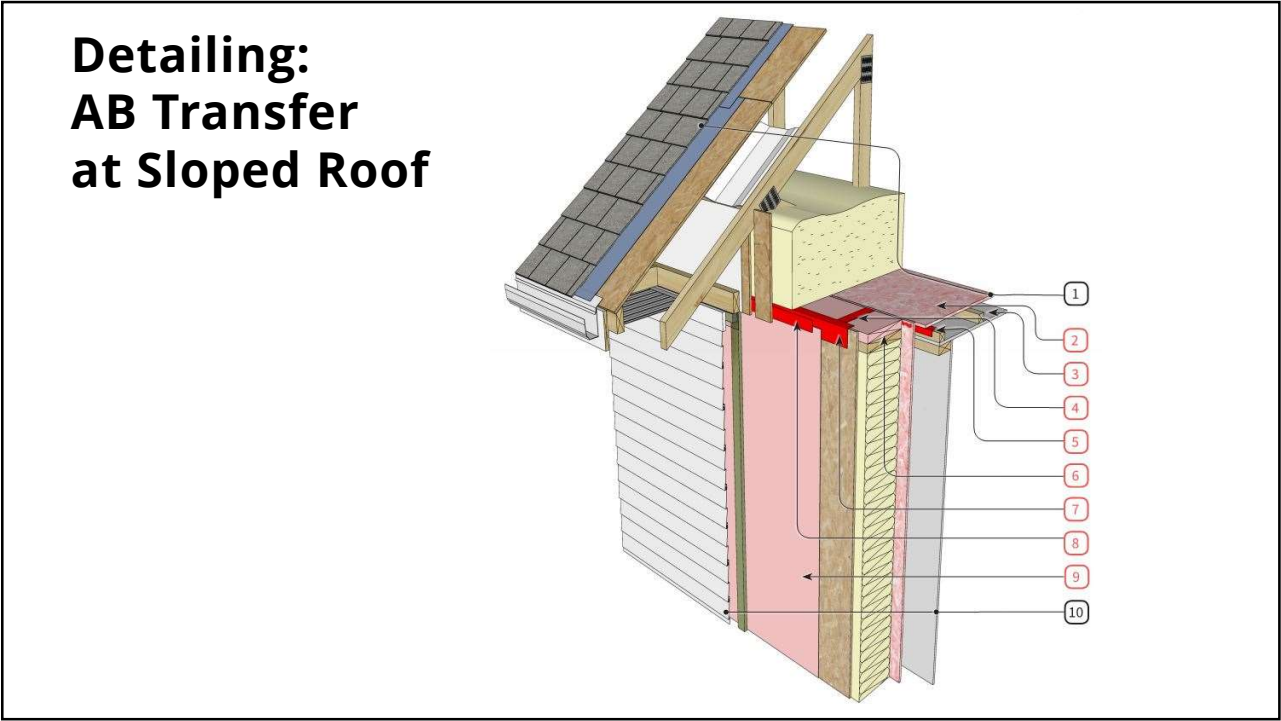
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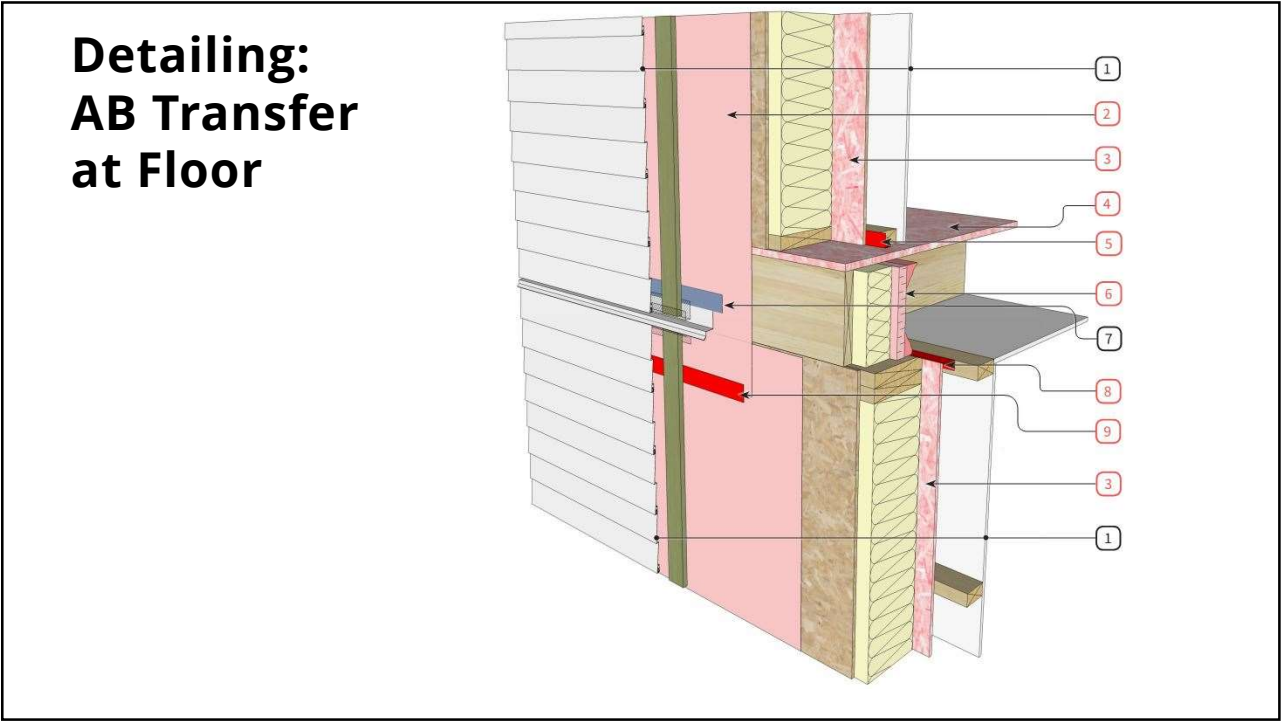
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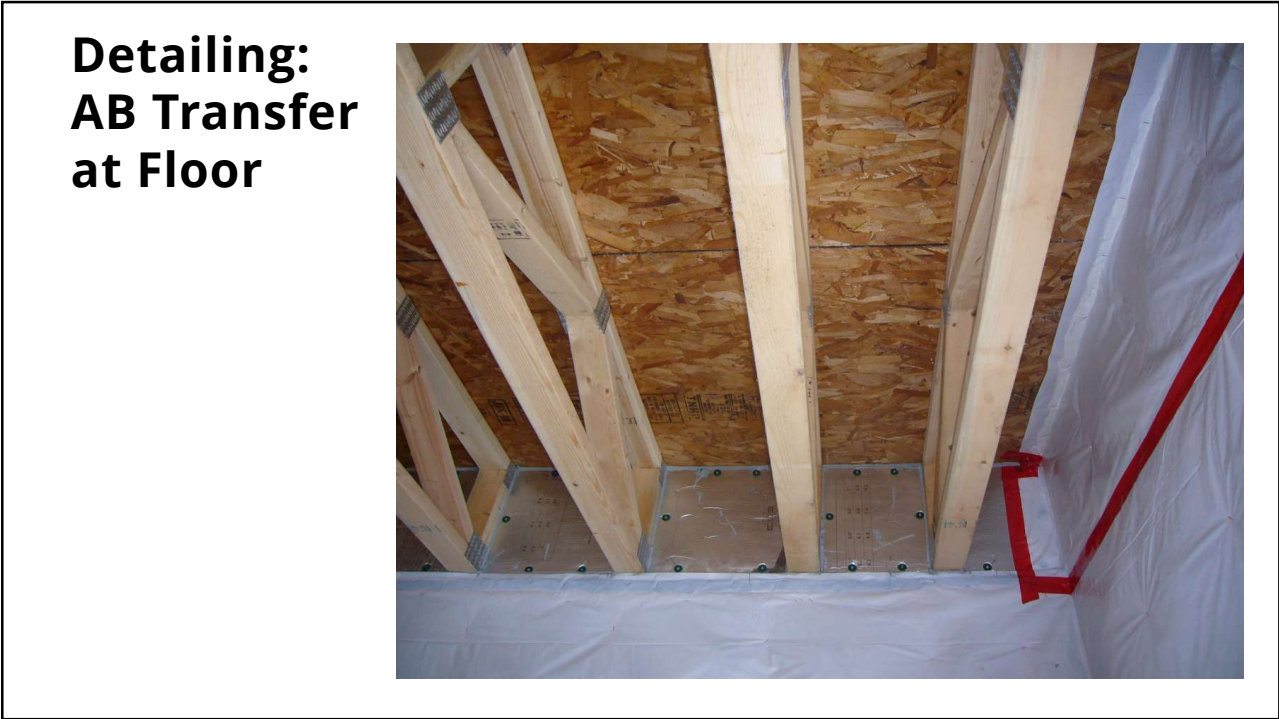
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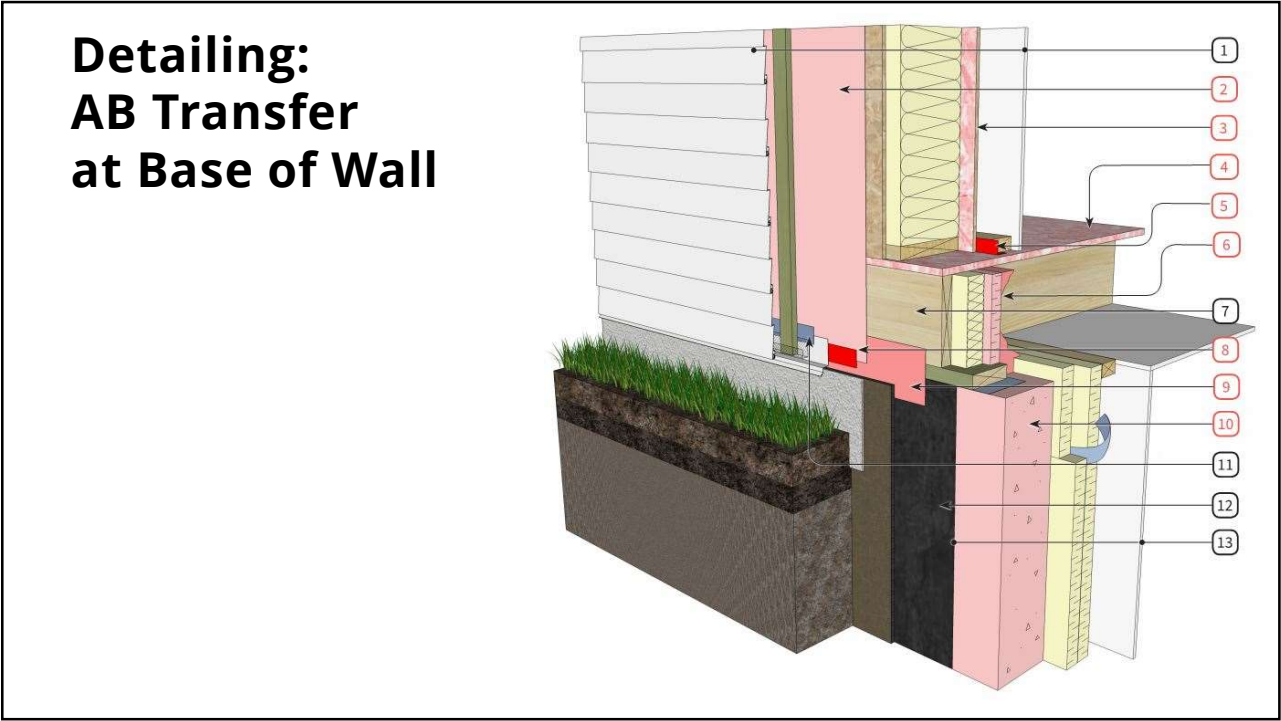
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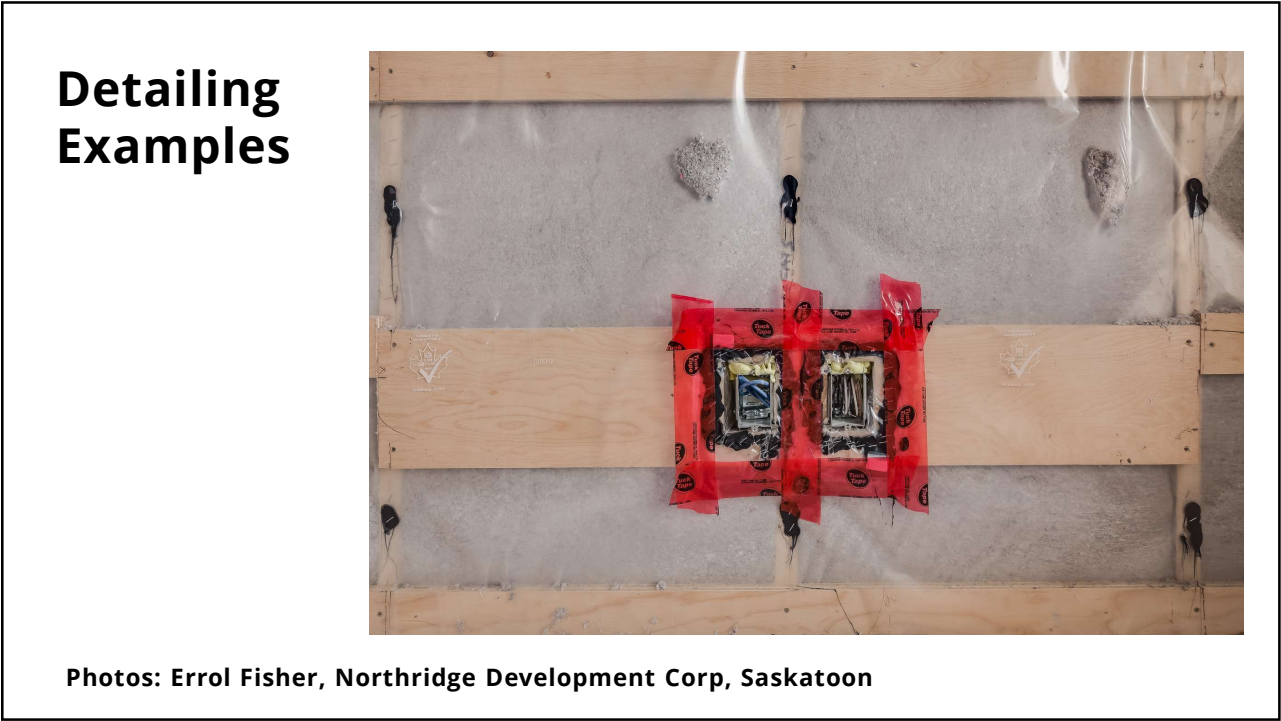
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Photos: Errol Fisher, Northridge Development Corp, Saskatoon

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NRCan Net Zero Energy Wall Guidelines

- Series of 4 Building Science Guidelines being developed for 4 common near net zero ready wall systems, R-30 to R-40 range
- Covers design & construction considerations
- Provides effective R-value tables
- Commentary on building science guidance (air, vapour, water) for each and rationale
- Includes cladding attachment fastener tables, costing information and builder checklists

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Detailing Guidelines – NRCan Net Zero Energy Ready Walls

Assembly Type 4 - Double Stud Wall with Cellulose Insulation, Air Tight Sheathing Membrane

Wall Assembly at Fibre Cement Board Siding

- Fibre Cement Board Siding
- Pressure Treated Wood Strapping/Air Cavity
- VP Sheathing Membrane (AB/WRB)
- Sheathing
- 2x4 Wood Framing filled with Cellulose Insulation
- 3 1/2" Gap filled with Cellulose Insulation
- 2x4 Wood Framing filled with Cellulose Insulation
- Poly Vapour Barrier
- Interior Gypsum Wall Board or

Alternate with Service Cavity for Mechanical & Electrical

- 2x3 horizontal Wood Framing with Batt Insulation
- Interior Gypsum Wall Board

*Alternate Service Wall
2x3 horizontal Wood Framing
with Batt Insulation*

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Typical Details

- DWG 4.03 | Base of Wall at Foundation
- DWG 4.04 | Cladding Transition at Floor Line
- DWG 4.05 | Wall & Roof Interface
- DWG 4.06 | Window Sill
- DWG 4.07 | Window Jamb
- DWG 4.08 | Window Head
- DWG 4.09 | Wall Penetration at Duct - Section
- DWG 4.10 | Wall Penetration at Duct - Plan View
- DWG 4.11 | Wall Penetration at Receptacle - Section

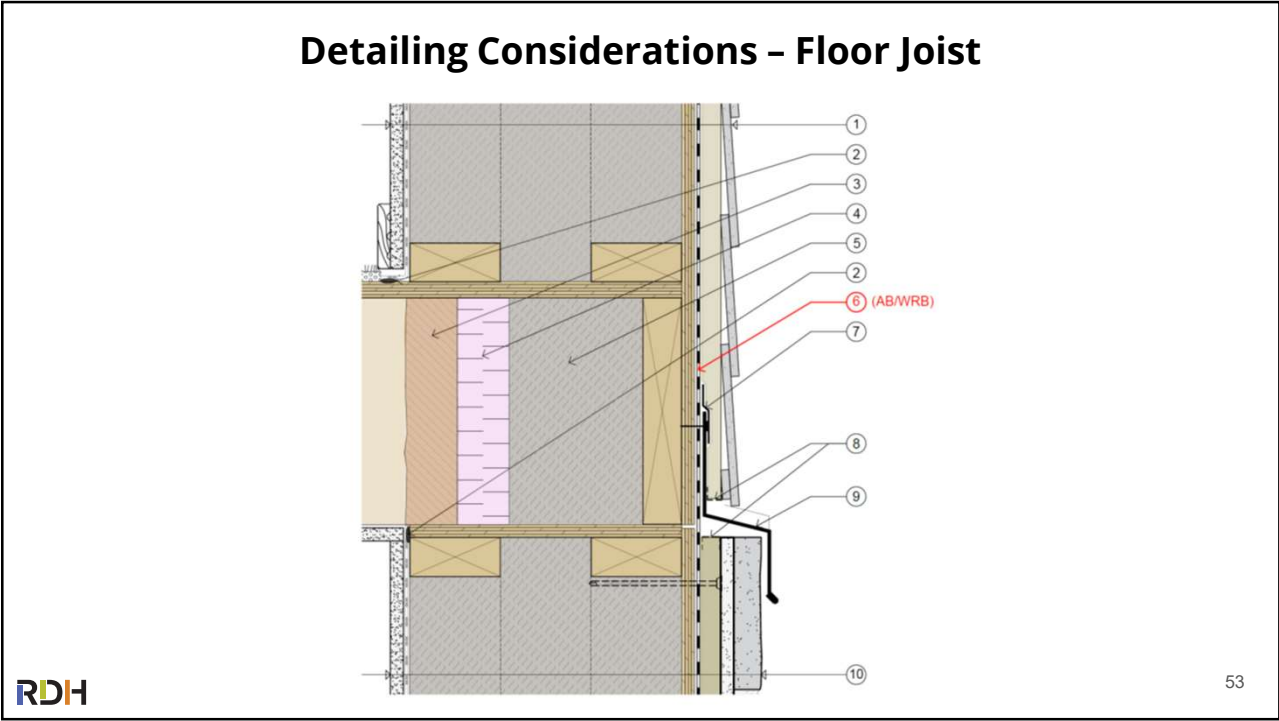
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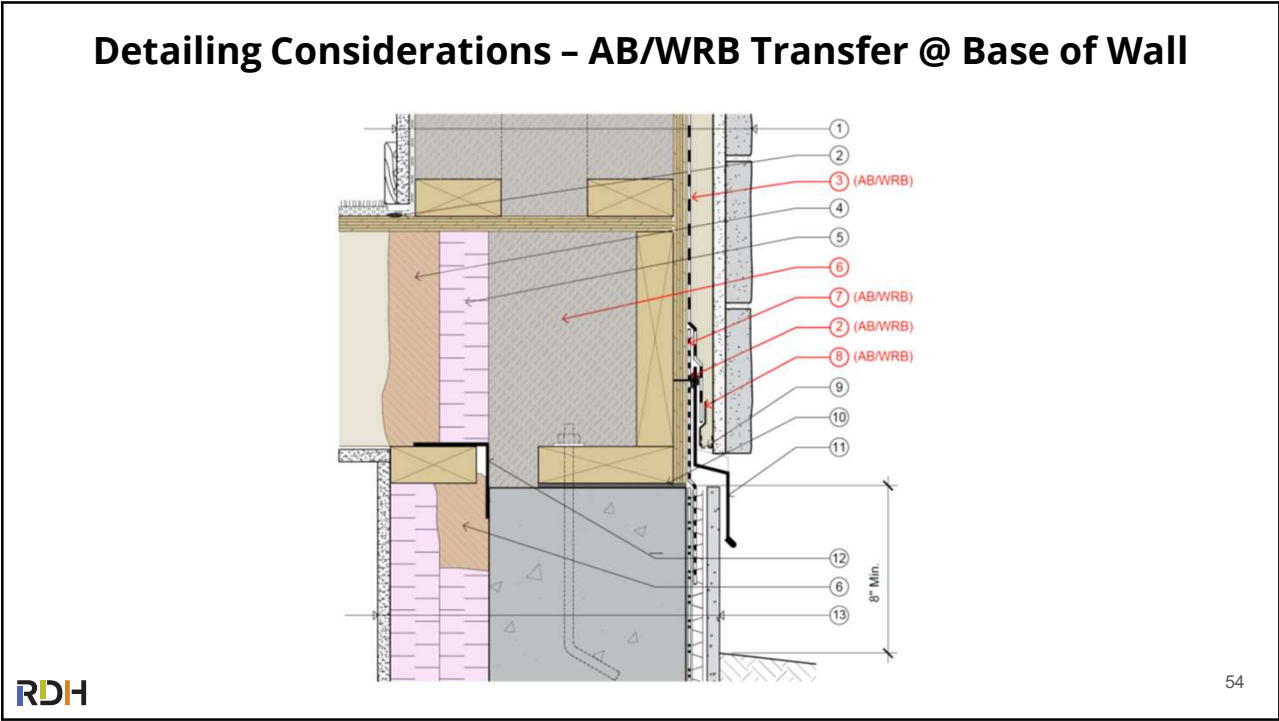
Detailing Considerations - Window

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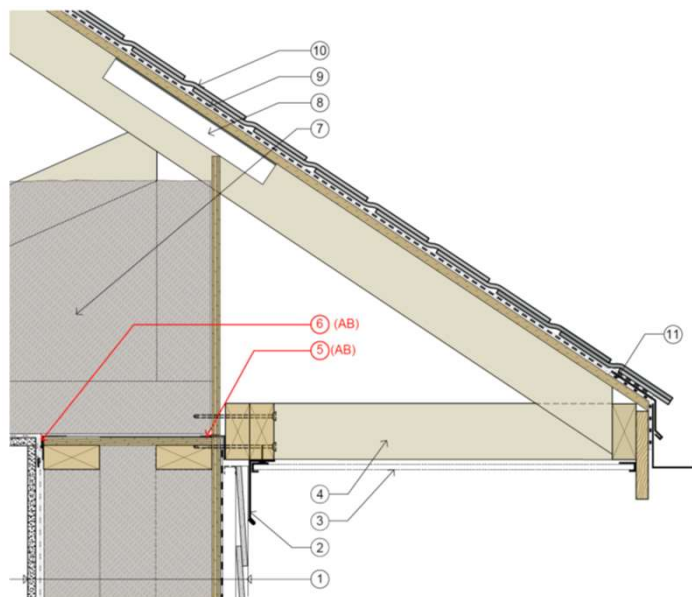


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Detailing Considerations – Roof to Wall Interface



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Key Points

- Many Design, Detailing and Material Options for Deep and Double Stud Wall Assemblies – Evolved Craftmanship
- Airtightness is Critical, More Insulated Walls are More Sensitive to Condensation and Dry Out Slowly
 - Details, Details, Details
 - Consider Protected Air Barrier Systems / Service Cavities
- Rainscreen Claddings & Details



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