# Performance and Durability of Wall Assemblies using Mineral Wool Exterior Insulation in the Pacific Northwest

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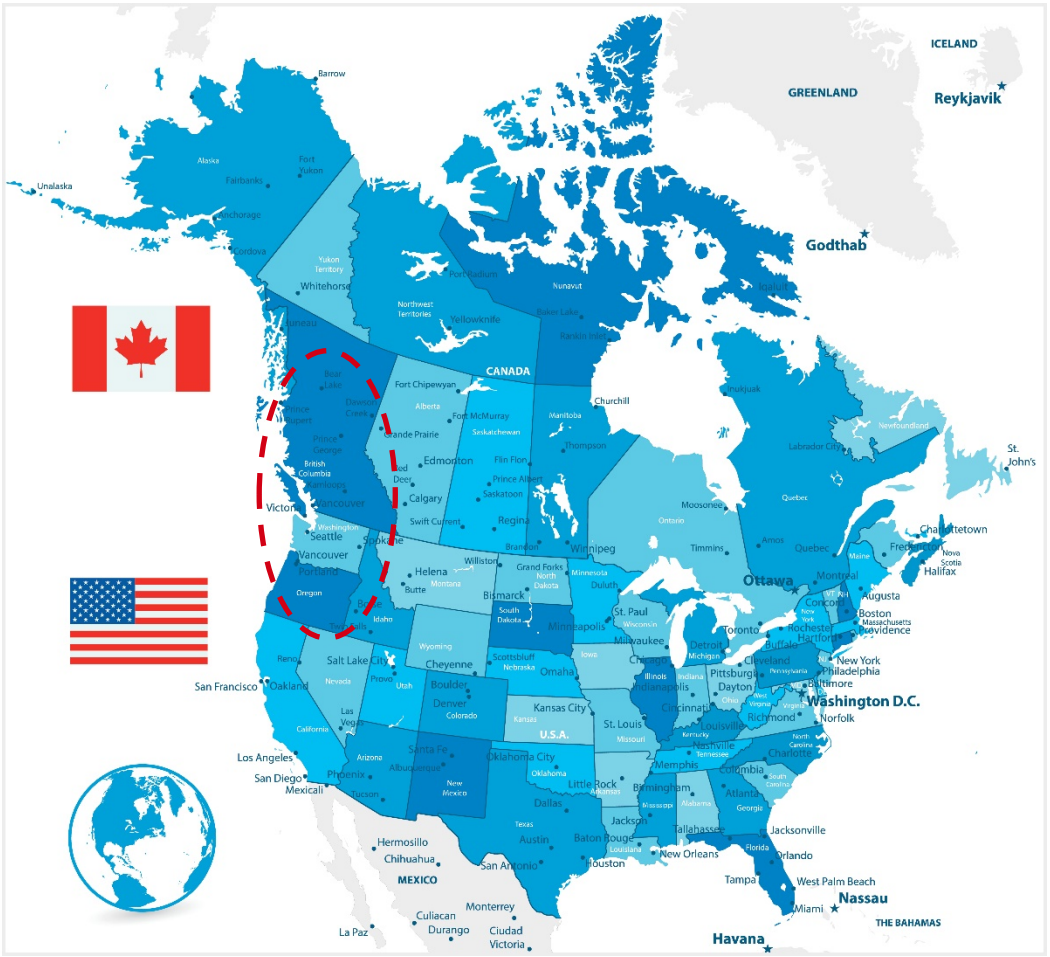
# Introduction – Pacific Northwest




- Climate Zones 4, 5 & 6
- Consistent rainfall
- Limited drying times between rainfalls

# Exterior Mineral Wool Applications


Orchards of Orenco, PHIUS Certified multi-unit residential building

1. Laboratory tested drainage analysis and comparison
2. Test hut performance analysis and comparison - Coquitlam, BC
3. In-situ performance analysis – Portland, OR

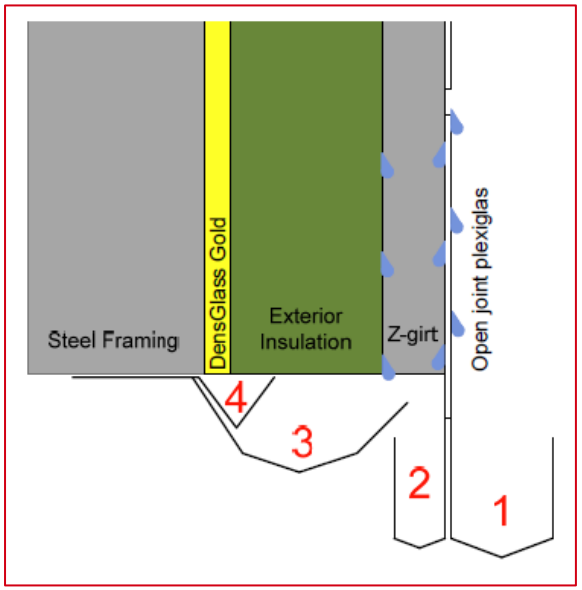
# Performance Evaluation Criteria

- Sheathing moisture content - highest likelihood location for moisture accumulation and durability risks in colder climates
- Sheathing relative humidity – taking into account temperature and duration of high levels and peaks
- Assembly/insulation drying times and rates
- Long-term durability analysis generally assessed with respect to relative risk, as opposed to being judged on a pass/fail basis.

# Laboratory Tested Drainage Testing


Stonewool test wall assembly hanging on drainage balance apparatus

Stonewool test wall assembly behind open joint plexiglass cladding




Schematic of drainage trough

Performance of the test walls compared on three main criteria:

1. The measured volume of water that was collected from each wall surface of the drainage troughs
2. The amount of water stored in the assembly following the water application
3. The length of time required for the wall to dry any stored water

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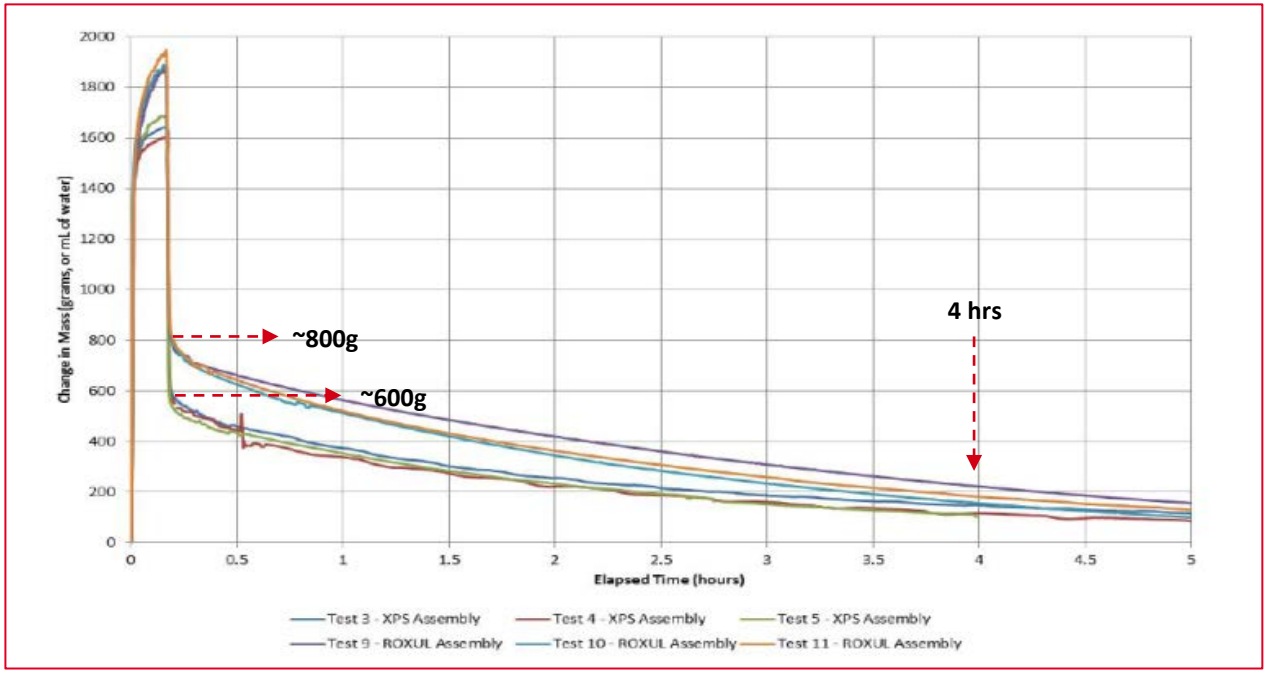
# Laboratory Tested Drainage Testing




Drying comparison, 10 min. water application @ 9.8L/min (2.6 GPM)

- For all test walls, over 85% of water, on average, was collected in front and behind cladding and on surface of insulation
- Initial water storage (@ 12 min mark), difference~ 200g (~66g/m2)
- After 4 hours of drying, difference ~ 43g/m2 and after 7 hours of drying, difference ~18g/m2

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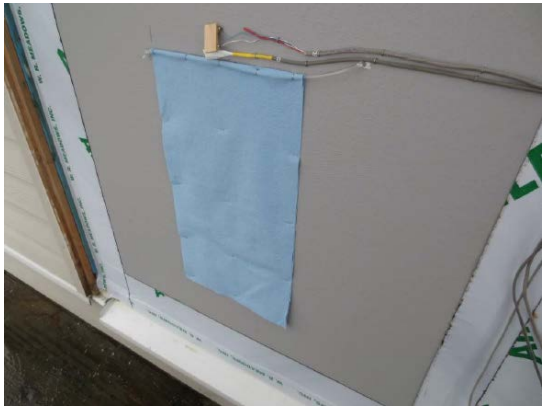
# Test Hut Coquitlam, BC

TABLE 1 - WALL CONSTRUCTION DETAILS

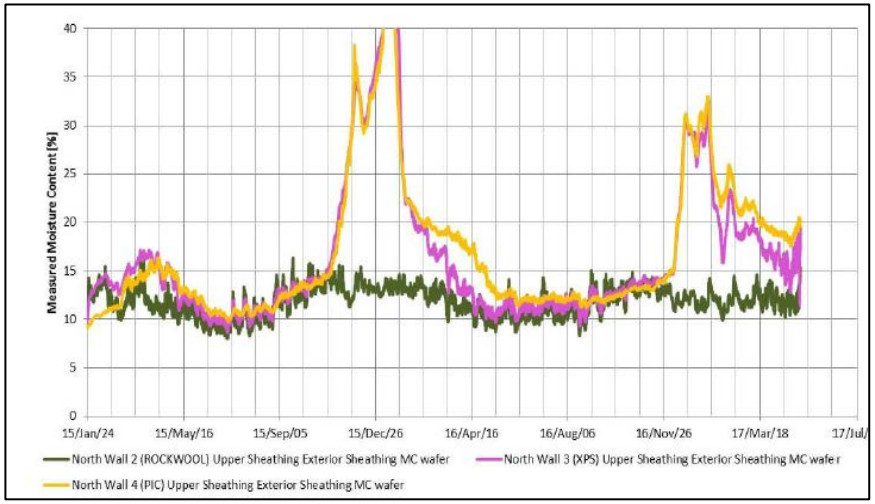
| Assemblies (North and South Orientation) | Framing | Interior Finish | Vapour Control | Thermal Insulation | Exterior Sheathing | Sheathing Membrane /Drainage Plane | Continuous Exterior Insulation | Exterior Cladding |
|---|---|---|---|---|---|---|---|---|
| | 2x6 wood<br>2x6 steel | 1/2" drywall + paint | latex paint | R-22.5 Rockwool ComfortBatt (steel stud)<br>R-22 Rockwool ComfortBatt (wood stud) | 1/2" DensGlass Gold<br>7/16" OSB | WR Meadows Air-Shield LMP<br>SBPO housewrap | R5 1¼" Rockwool ComfortBoard™ 80<br>R8 2" Rockwool ComfortBoard™ 110<br>R7.5 1½" XPS polystyrene<br>R9.8 1½" foil-faced POLYISO | Fiber Cement lapsiding<br>Open Joint Fiber Cement Siding |
| Wall 1 | • | • | • | • | • | • | • | • |
| Wall 2 | • | • | • | • | • | • | • | • |
| Wall 3 | • | • | • | • | • | • | • | • |
| Wall 4 | • | • | • | • | • | • | • | • |



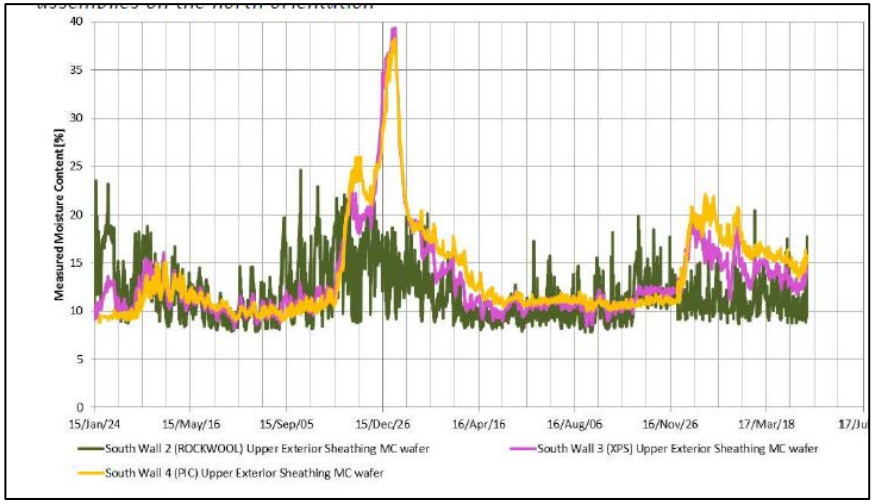
Upper: Test wall assemblies, south orientation

Left: Wetting instrumentation, between water resistive barrier and exterior insulation (not shown)

# Test Hut
# Coquitlam, BC




North Wall – Moisture Content in wood wafer @ exterior side of exterior gypsum sheathing (top)




South Wall – Moisture Content in wood wafer @ exterior side of exterior gypsum sheathing (top)

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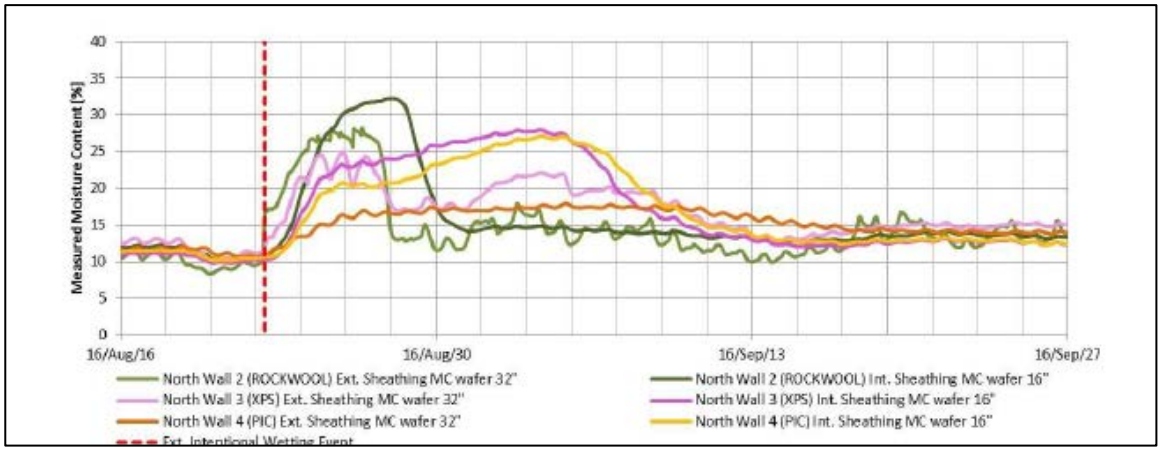
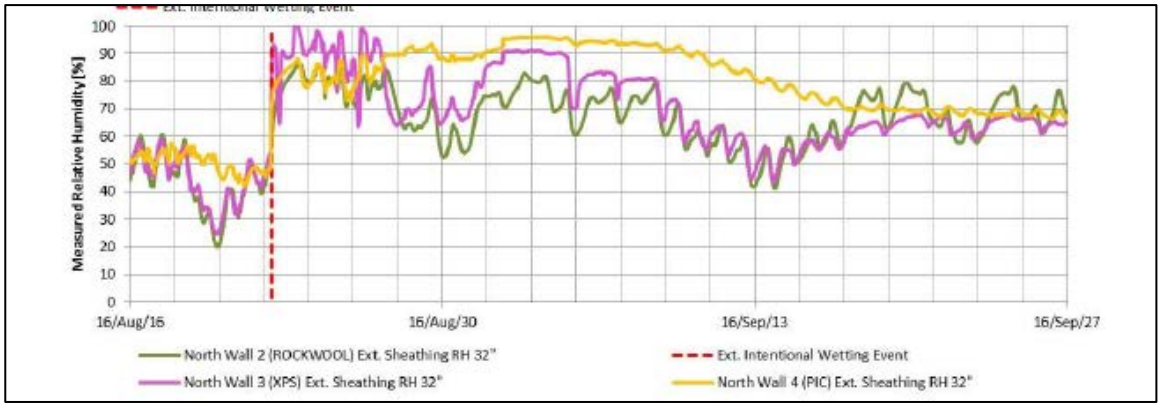
# Test Hut Coquitlam, BC




North orientation moisture content in wood wafer @ interior and exterior side of sheathing comparison during wetting event – August 2016




North orientation relative humidity@ exterior side of sheathing comparison during wetting event – August 2016

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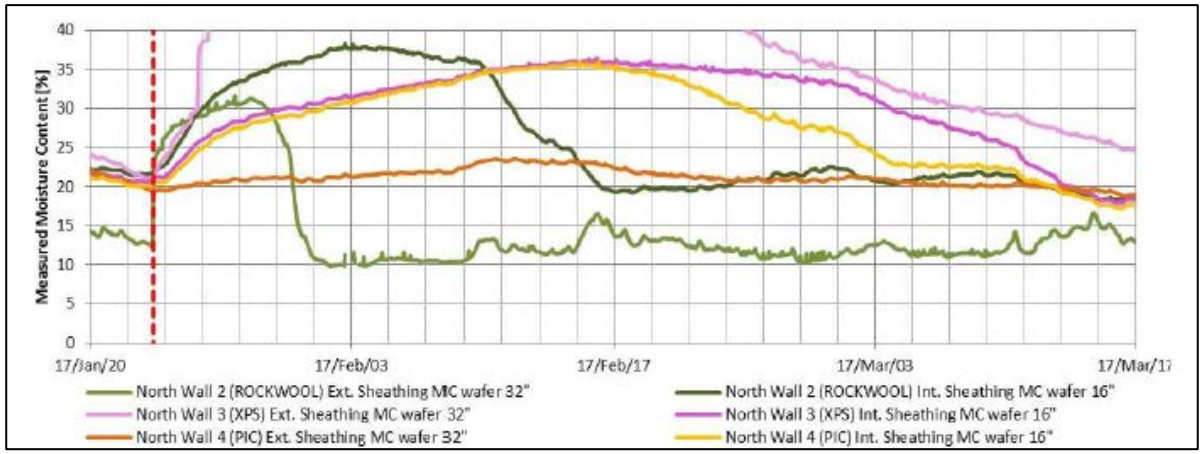
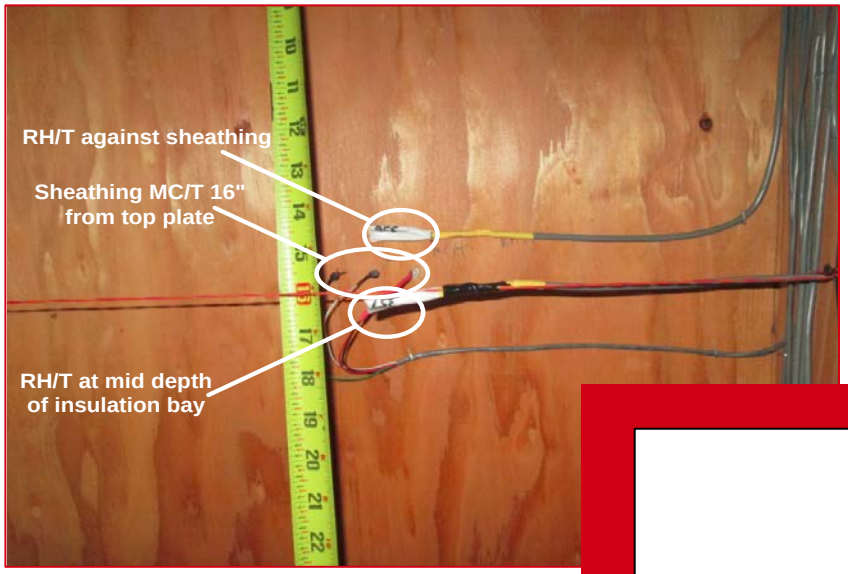
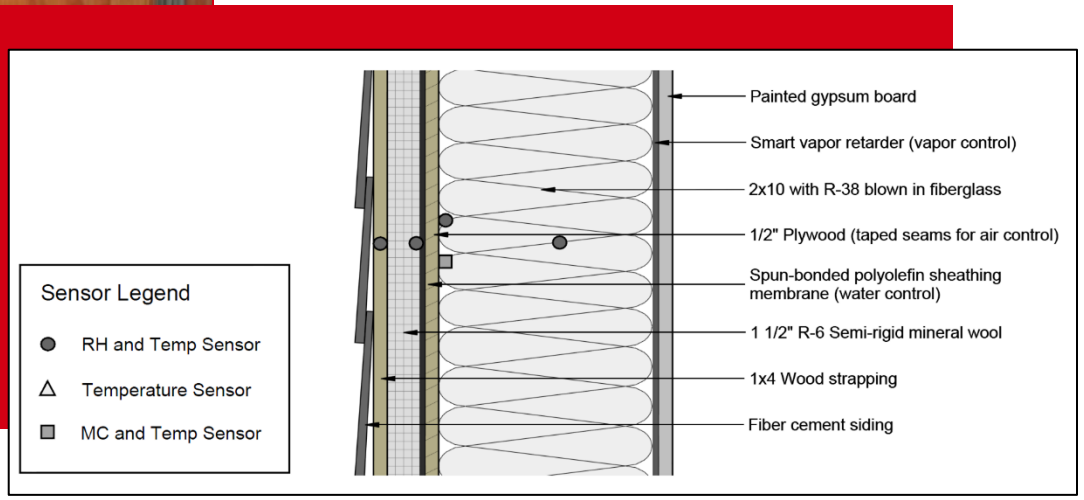



North orientation moisture content of wood wafer @ interior and exterior side of sheathing comparison during wetting event – January 2017


North orientation relative humidity @ exterior side of sheathing comparison during wetting event – January 2017

# In-situ Monitoring Hillsboro, OR



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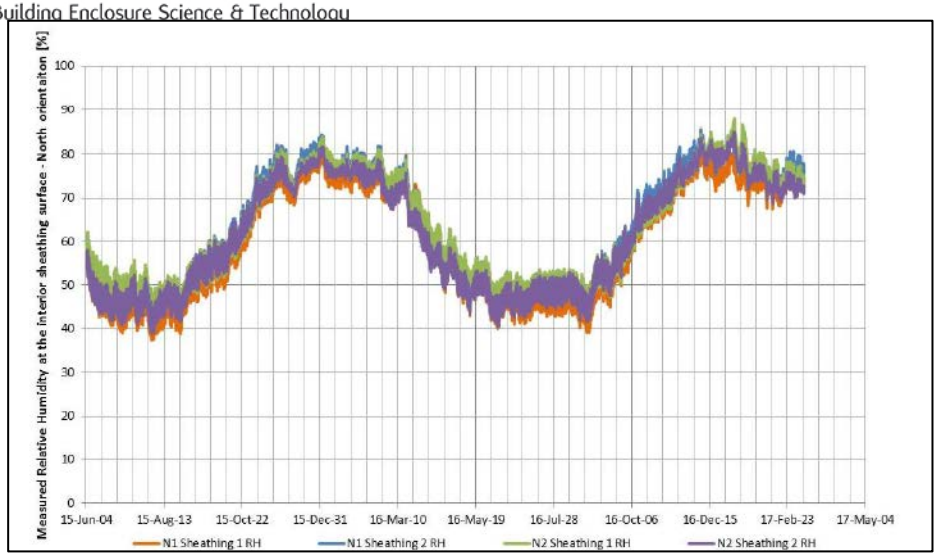
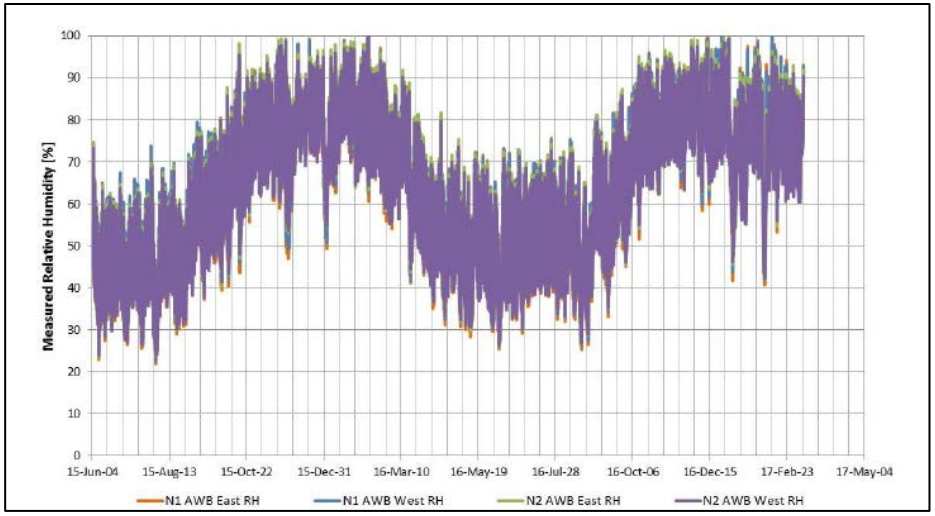



North orientation relative humidity @ interior side of WRB – Suite 1 & 2




North orientation relative humidity @ exterior side of WRB – Suite 1 & 2

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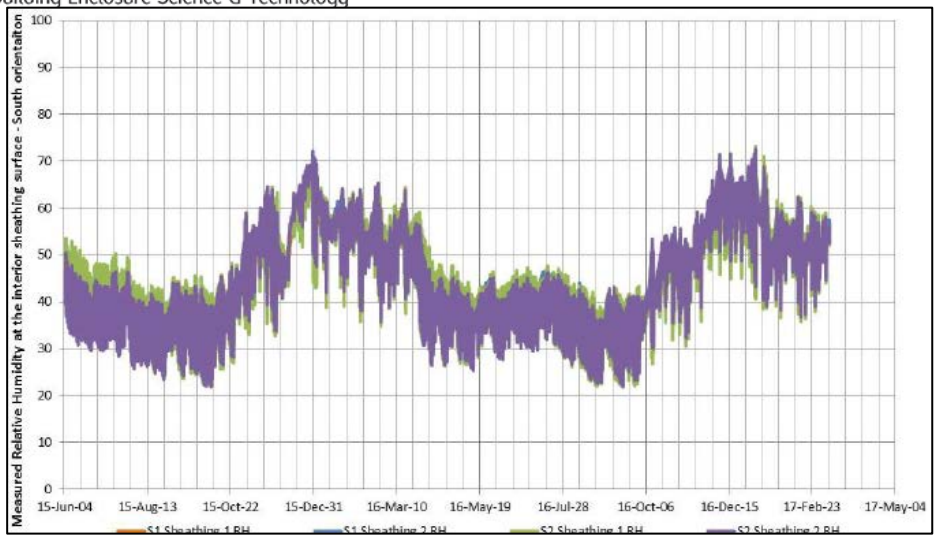
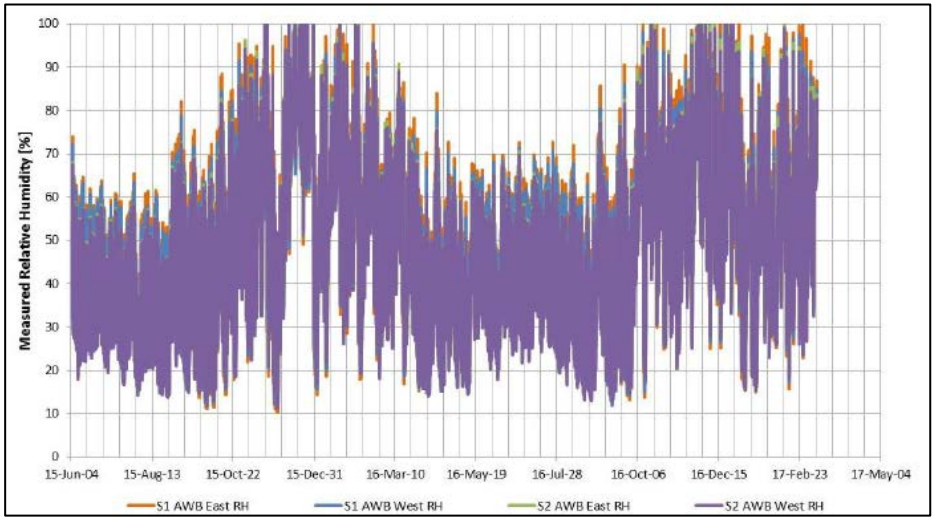



South orientation relative humidity @ interior side of WRB – Suite 1 & 2




South orientation relative humidity @ exterior side of WRB – Suite 1 & 2

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# Summary

- Drainage balance testing demonstrates that mineral wool insulation, installed behind open-joint cladding, retains less than 1% of water after 4 hours of drying
- Test hut analysis in Coquitlam, BC indicates adequate sheathing conditions when using mineral wool exterior insulation, in combination with a vapour permeable water resistive barrier, taking into account intentional wetting events
- In-situ performance analysis of mineral wool insulation outside Portland, OR demonstrates adequate performance without risks of moisture accumulation or durability concerns

# References


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# Acknowledgments





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## Thank you.

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