Window Sill Pan Flashings: Are Liquid Membranes Suitable?

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RDH BUILDING SCIENCE

Outline

- → Industry sill flashing practices
- → What about liquid membranes?
- → Long term water ponding testing
- → Drying potential evaluation
- → Gap bridging ability
- → Conclusions

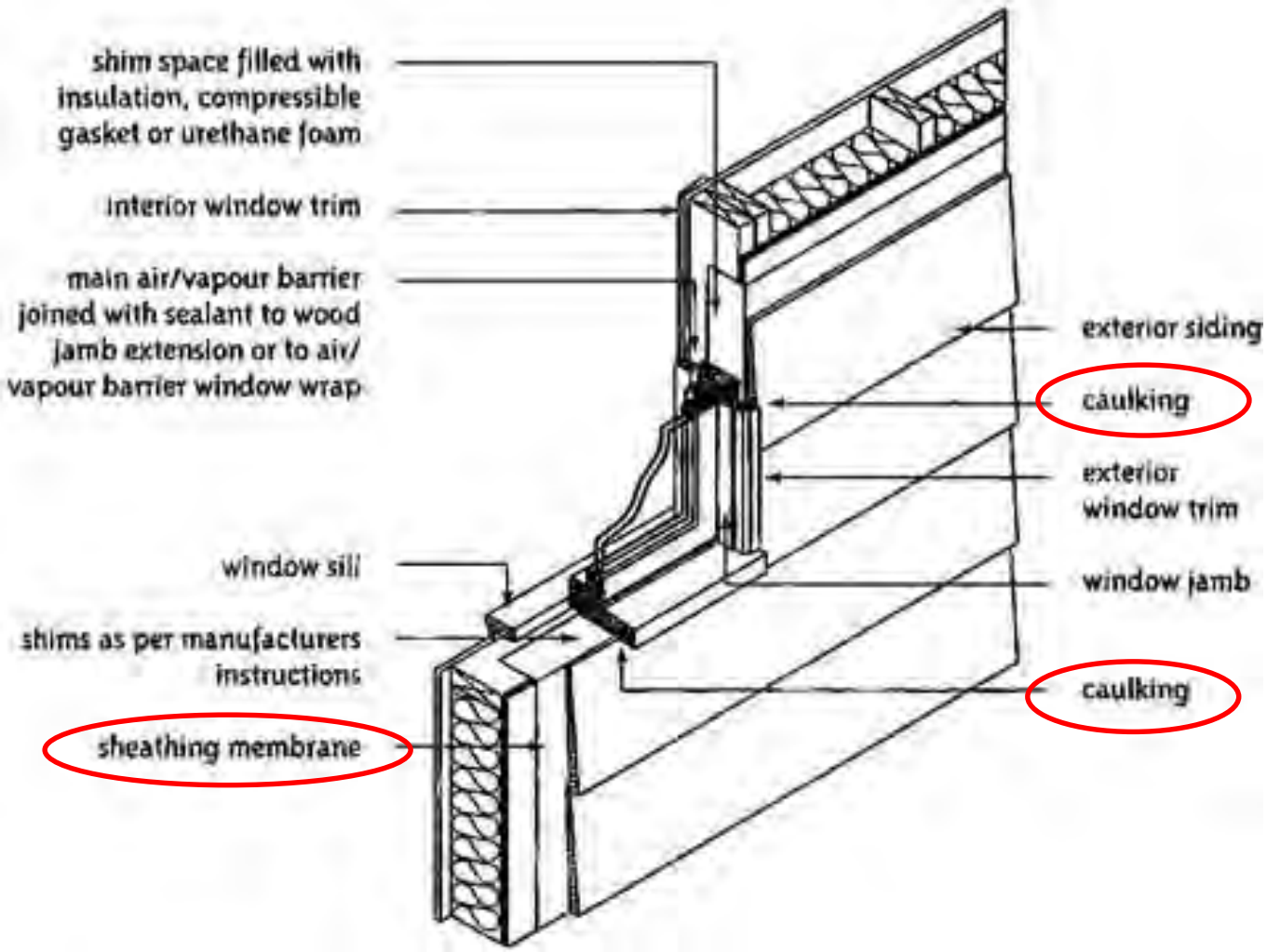
Impermeable self-adhered membranes work adequately

Construction details can be complex

TOO MUCH Impermeable self-adhered membrane

TOO MUCH Impermeable self-adhered membrane

Vapour permeable sheet/self-adhered products not acceptable



Vapour permeable sheet/self-adhered products not acceptable

What about liquid membranes?

→ Vapour permeable liquid applied membranes becoming more common for treating window rough openings

→ Impermeable self-adhered membrane still applied at sill

→ Can be cost effective and simpler

Vapour permeable liquid flashings suitable at sill?

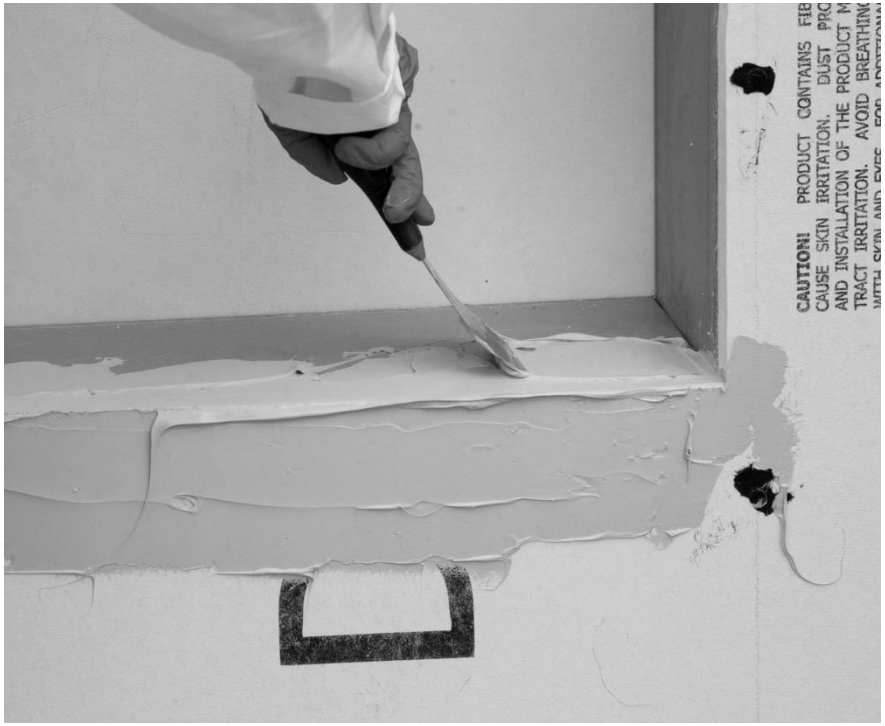
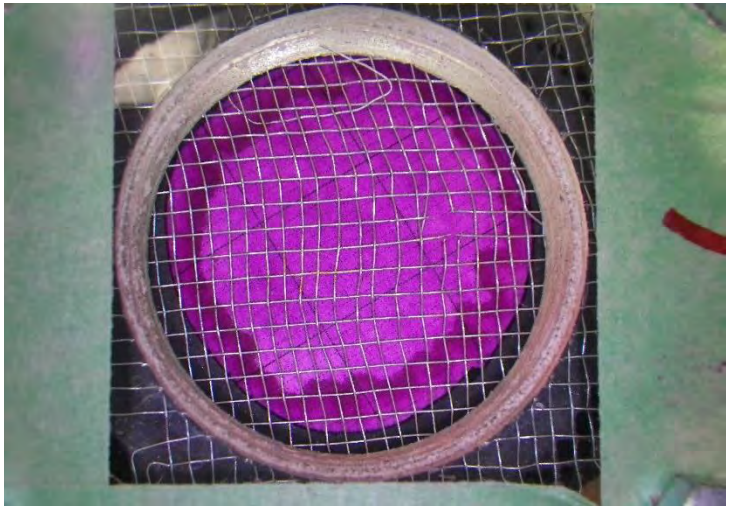


Photo Credit: Green Building Advisor

Vapour permeable liquid flashings suitable at sill?



- → Several related standards and guidelines
  - → AATCC 127
  - → AAMA 711-13
  - → AAMA 714-15
    - › ASTM C1305-00
    - › ASTM E96 Method B
- → Existing evaluation standards are sufficient for some properties including nail sealability, UV and temperature stability, etc.
- → BUT some performance metrics are not covered satisfactorily
  - → Membranes with similar vapour permeances but widely different water absorption rates
  - → Variable gaps between steel/wood framing and wall sheathing at rough opening

Vapour permeable liquid flashings suitable at sill?

→ Existing industry standards and guidelines do not yet adequately cover liquids applied in horizontal applications

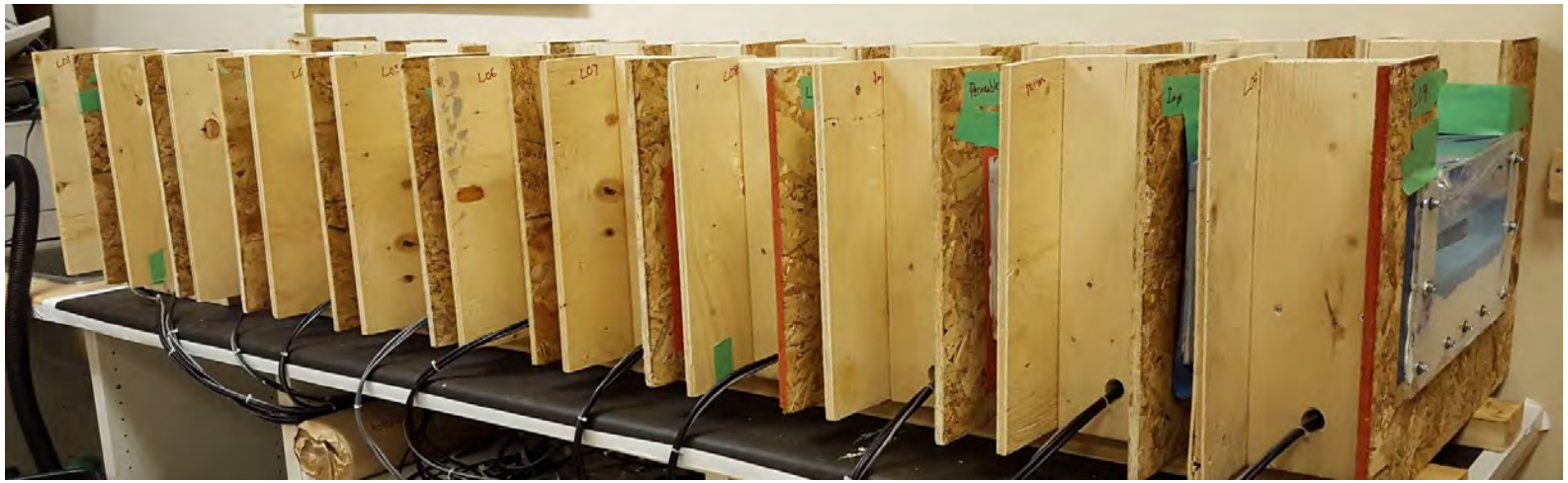
→ Key considerations and potential issues:

- → Water ponding resistance
- → Drying potential
- → Flexibility and gap bridging ability
- → Compatibility and adhesion with other materials
- → Weather dependent curing (rainwater, cold, heat)
- → Workability and ease of application
- → Longevity, durability, exposure to UV & heat

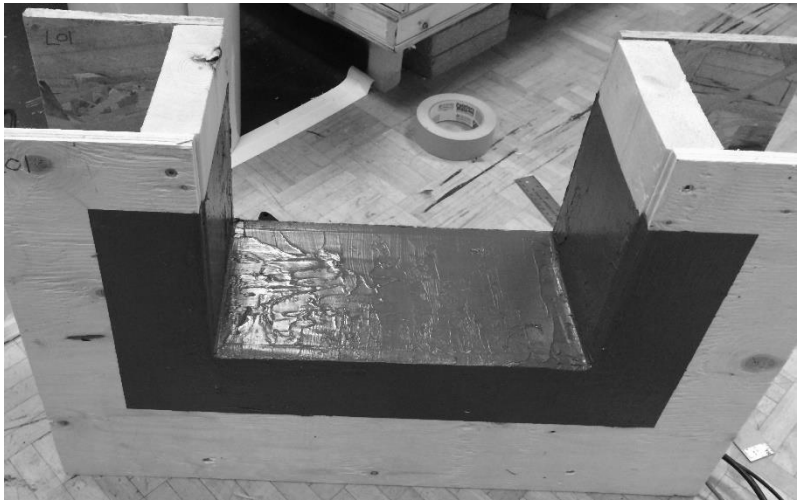
Long term water ponding resistance

→ Devised test to demonstrate the potential for water uptake through vapor permeable liquid flashing membranes on horizontal surfaces (wood sill, OSB and plywood edges)

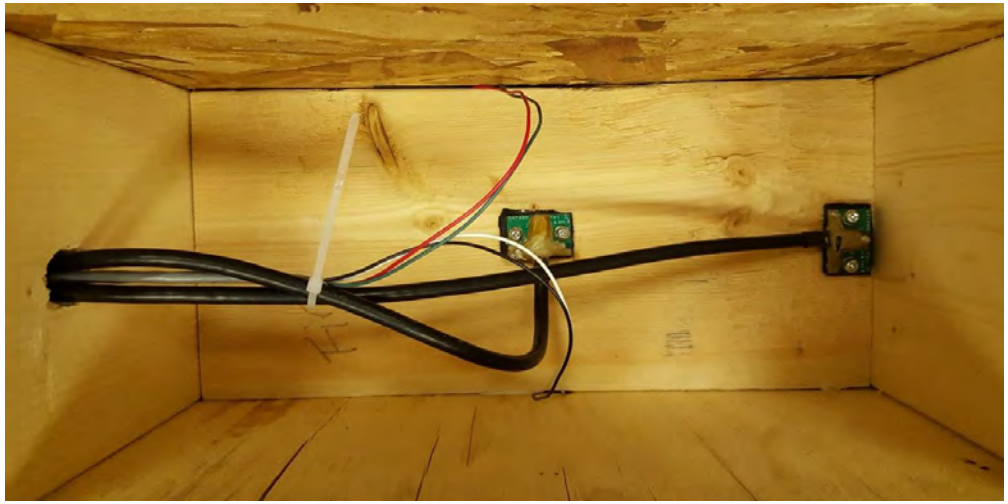
- → Industry awareness that impermeable self-adhered membranes work adequately in this application and that permeable sheet goods (housewrap) are not suitable.
- → No comparative data to suggest what vapor permeable water repellant liquids may be suitable for this application
- → Compared liquid membrane results with self-adhered control membranes that were known to work well or fail



Window sill setup



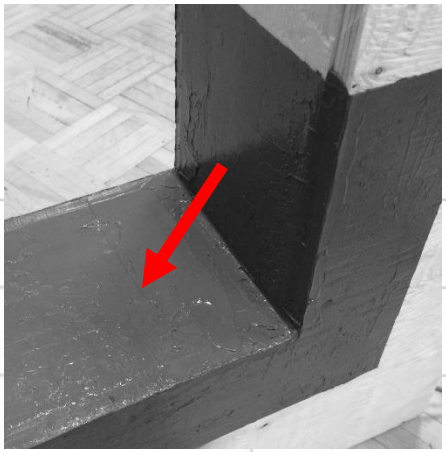
Window sill mockup with 2x6 sill and OSB and plywood sheathing

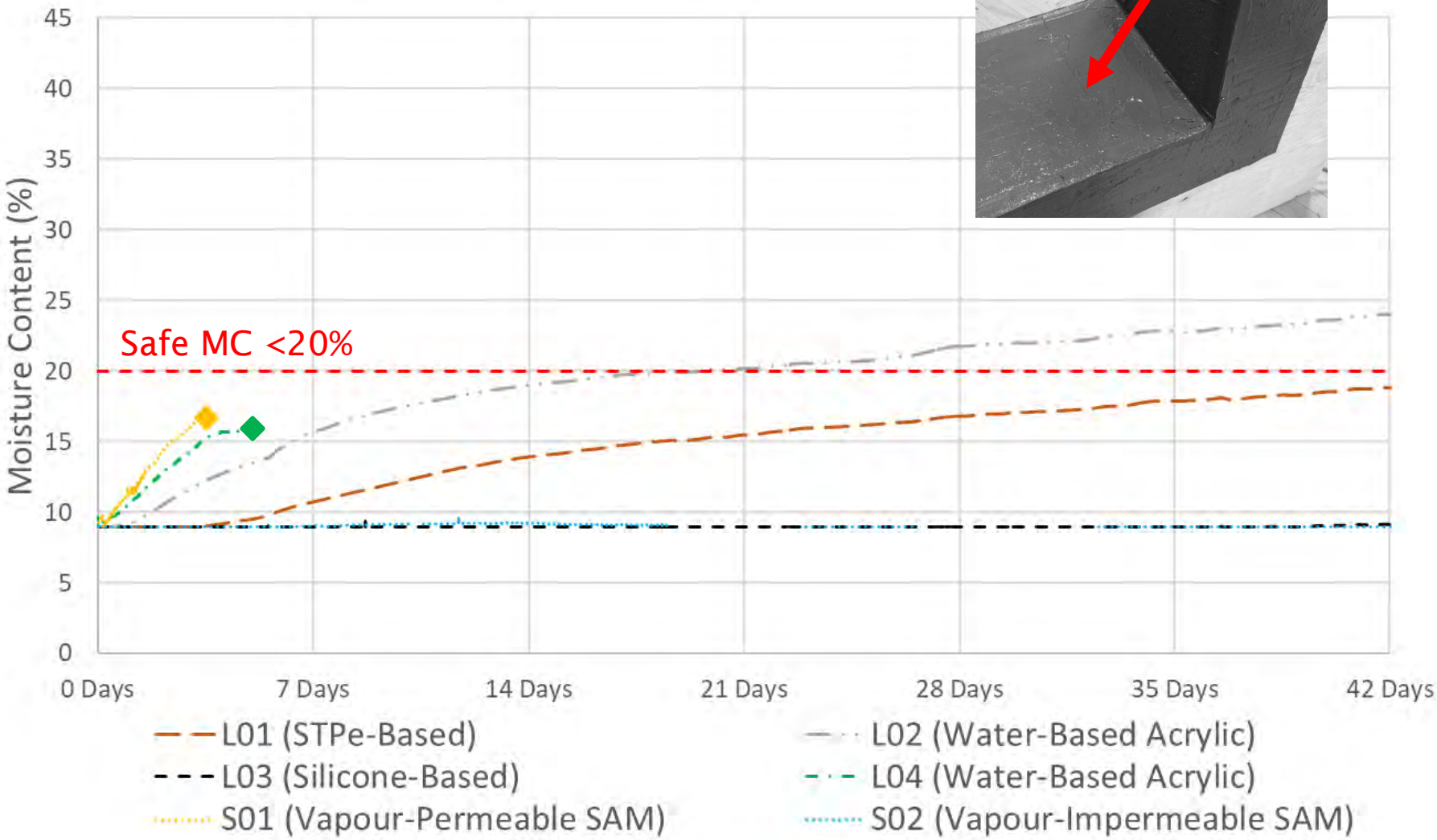


Moisture content pins installed into wood at critical locations

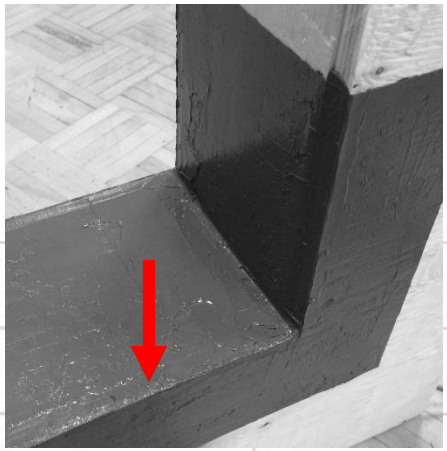
Setup to pond water on liquid membrane surface

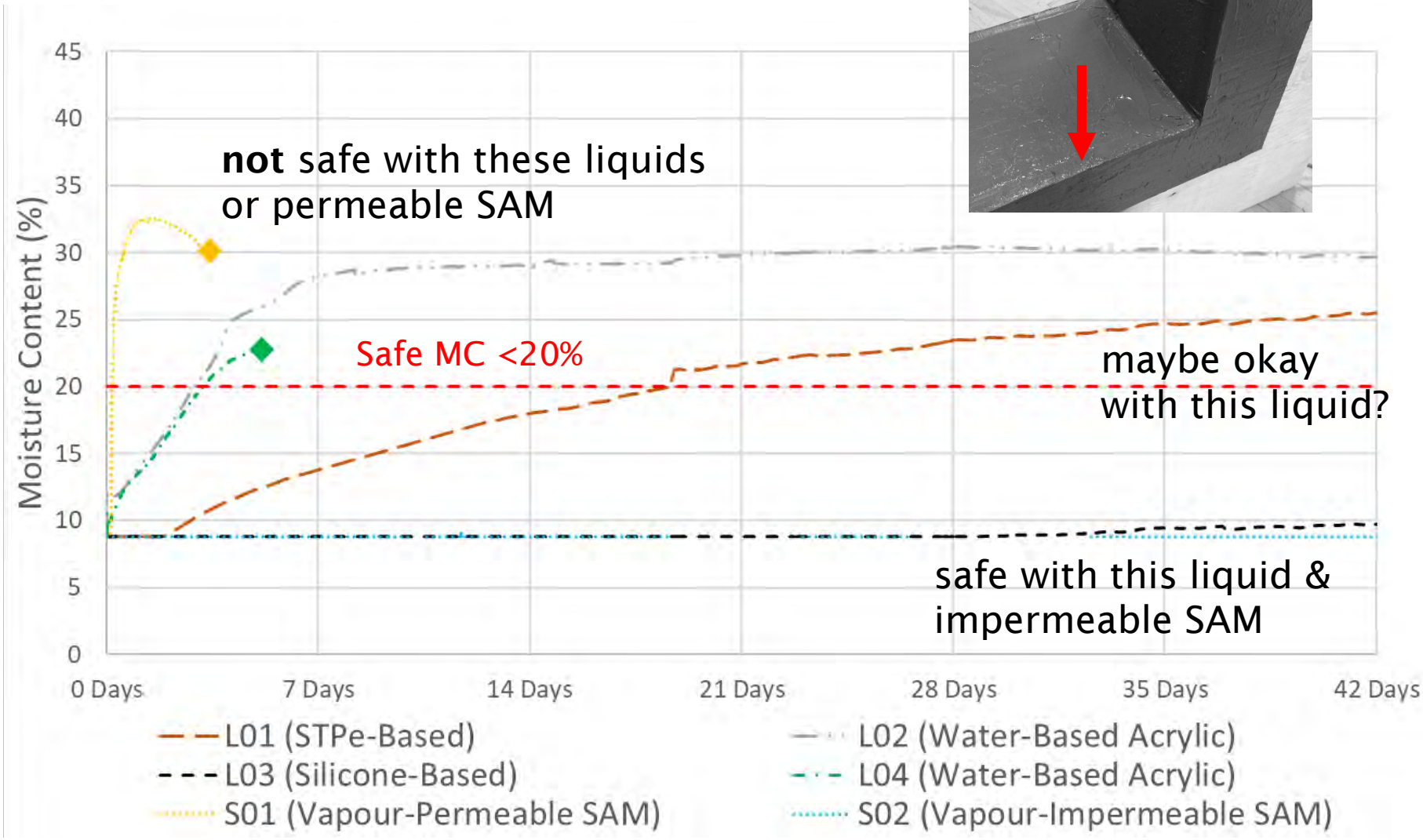
Window sill wetting – Results
2x Framing



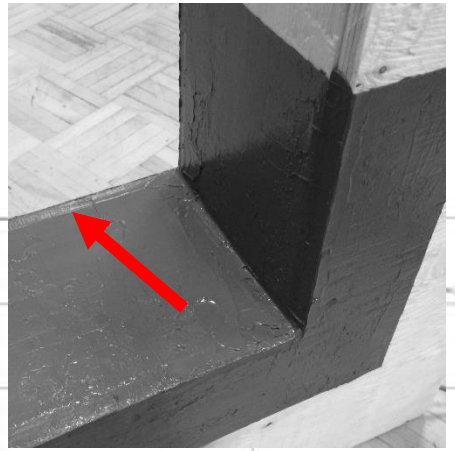


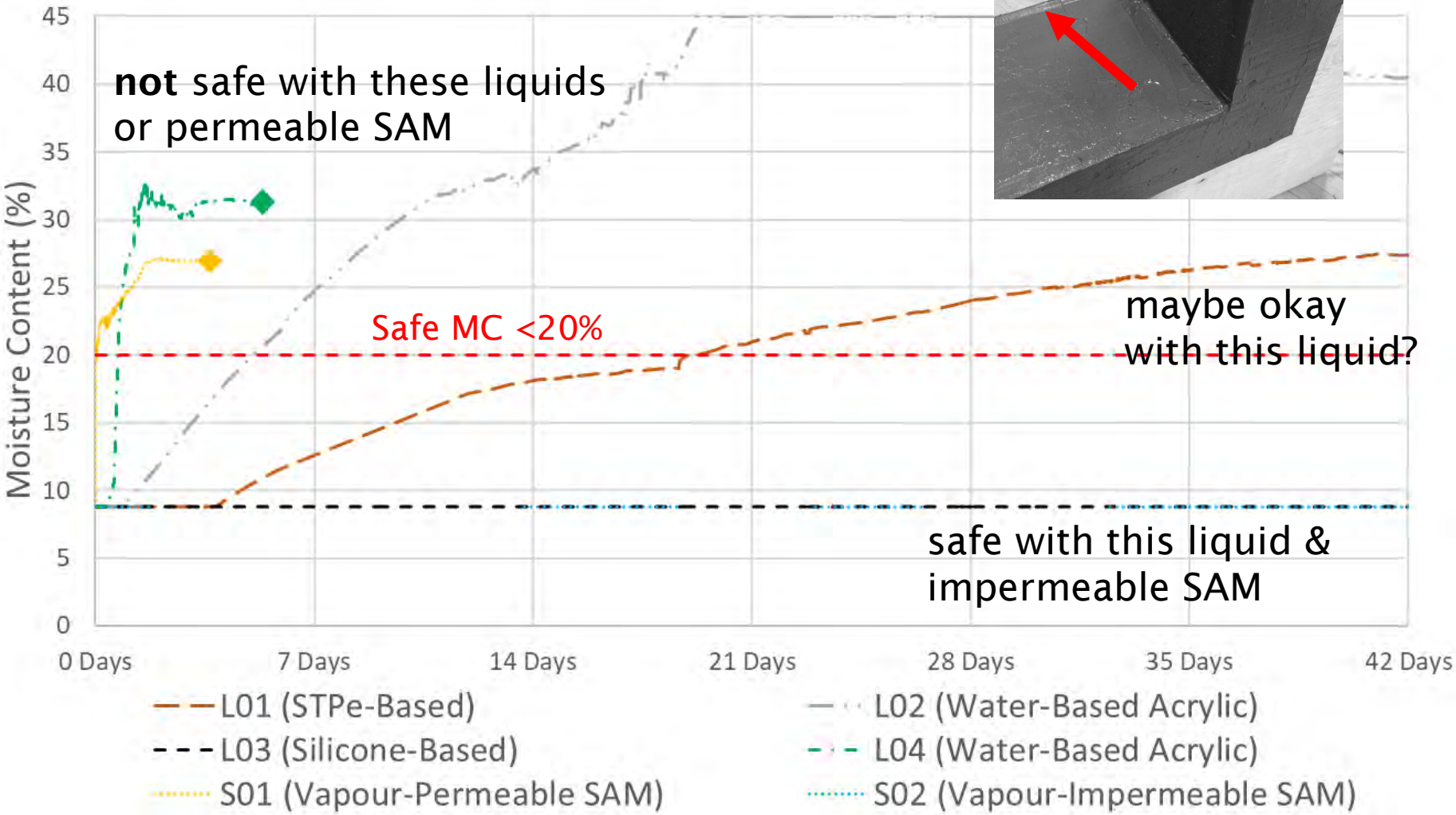
Window sill wetting – Results
Plywood



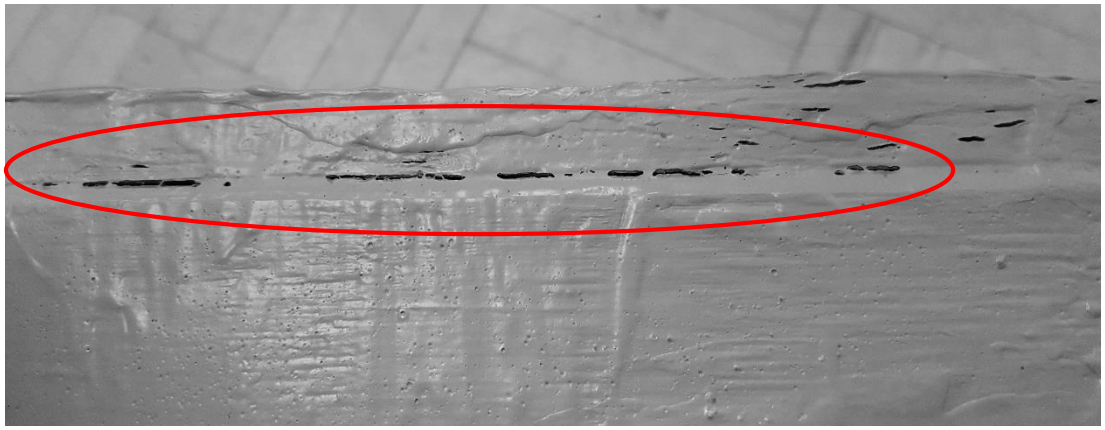


Window sill wetting – Results
OSB

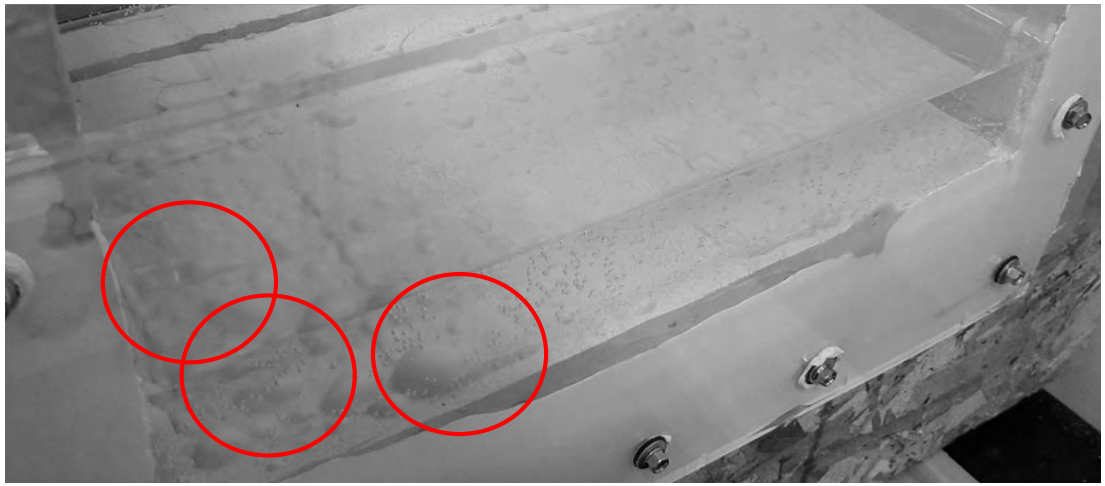




Window sill wetting – Observations



Swelling failure liquid membrane at OSB resulting in leak

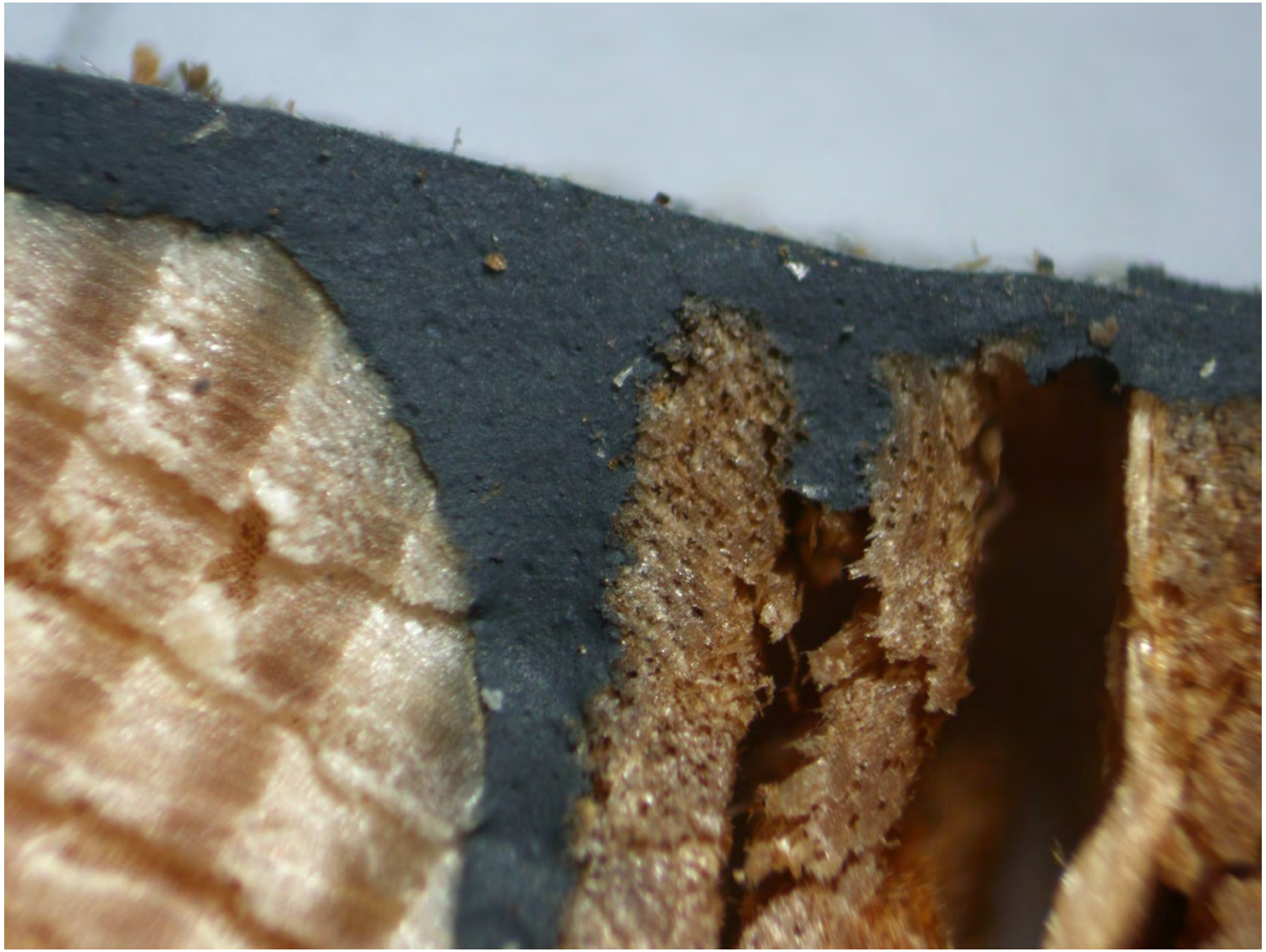


Excessive absorption of liquid membrane and discoloration

Window sill wetting – Observations

Mould after 30 days due to absorption into OSB sheathing below a relatively absorptive & permeable liquid applied window sill flashing

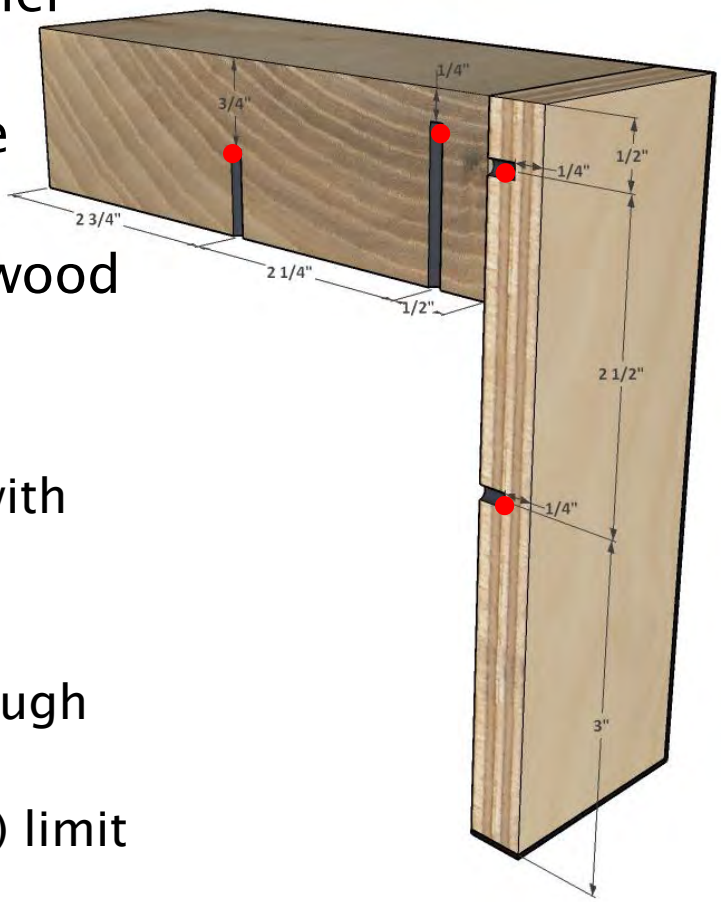
Window sill wetting – Observations



Drying potential evaluation

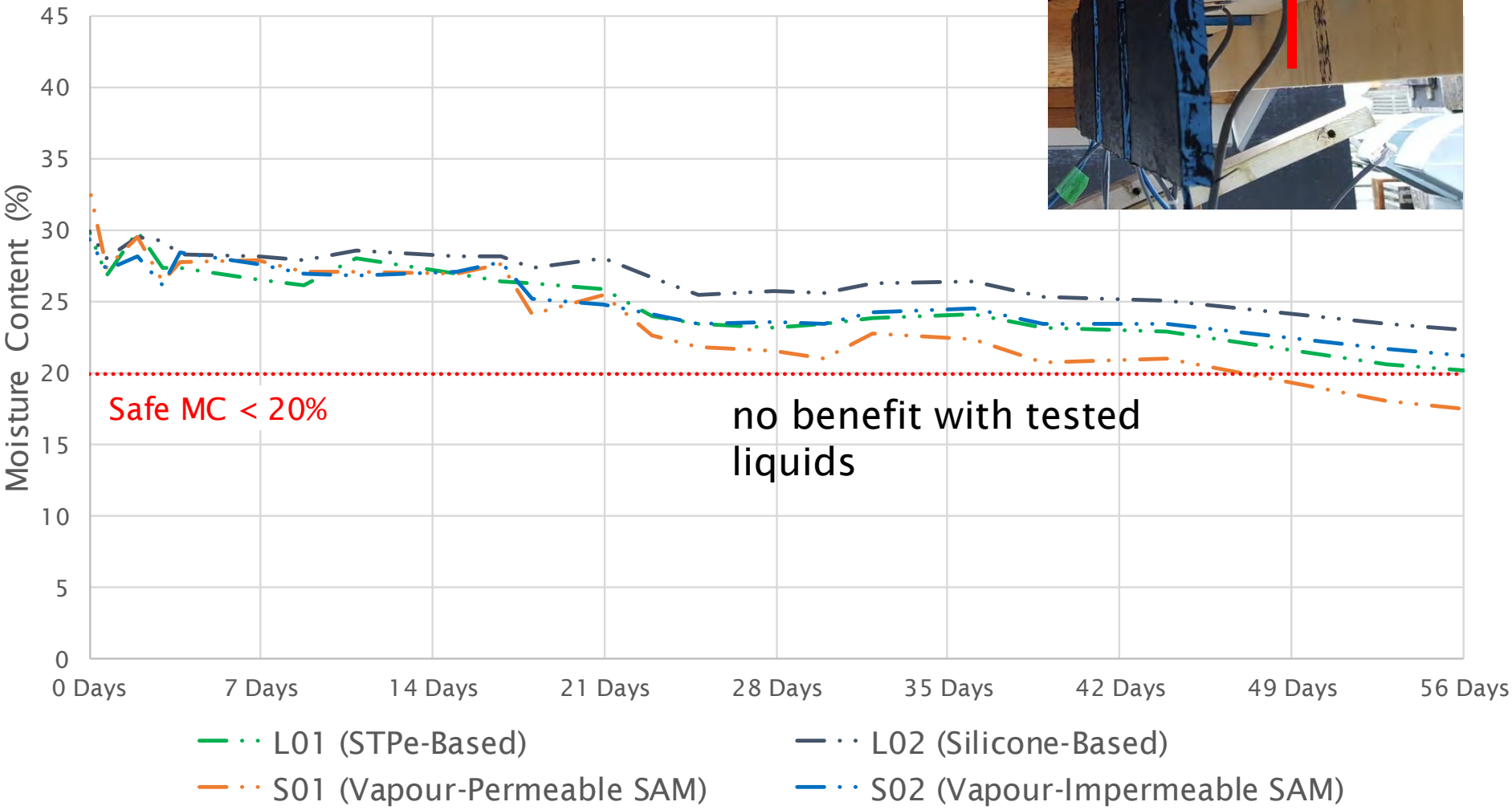
→ Devised test to demonstrate whether improved drying characteristics manifest through vapor permeable liquid flashing membranes on horizontal surfaces (wood sill, plywood edge)

- → Wood-framing often wetted during construction in Pacific Northwest with little opportunity to dry in winter months
- → Potential for enhanced drying at rough opening if interior window framing (king studs, cripple studs, headers) limit drying to the interior
- → Compared liquid membrane results with permeable and impermeable self-adhered membranes

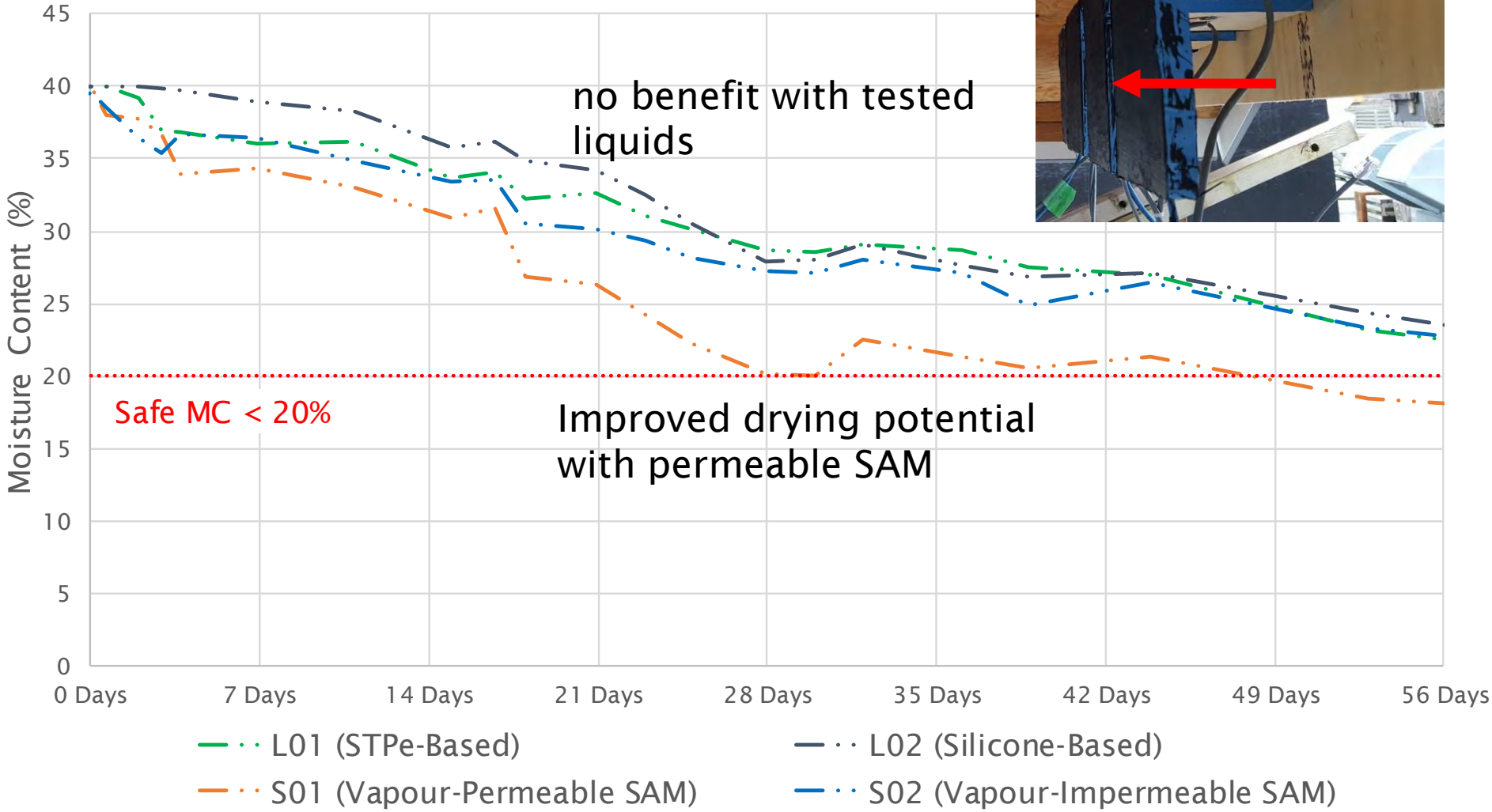


Moisture content pins installed into wood at critical locations (red dots)

Window mock-up drying – Results



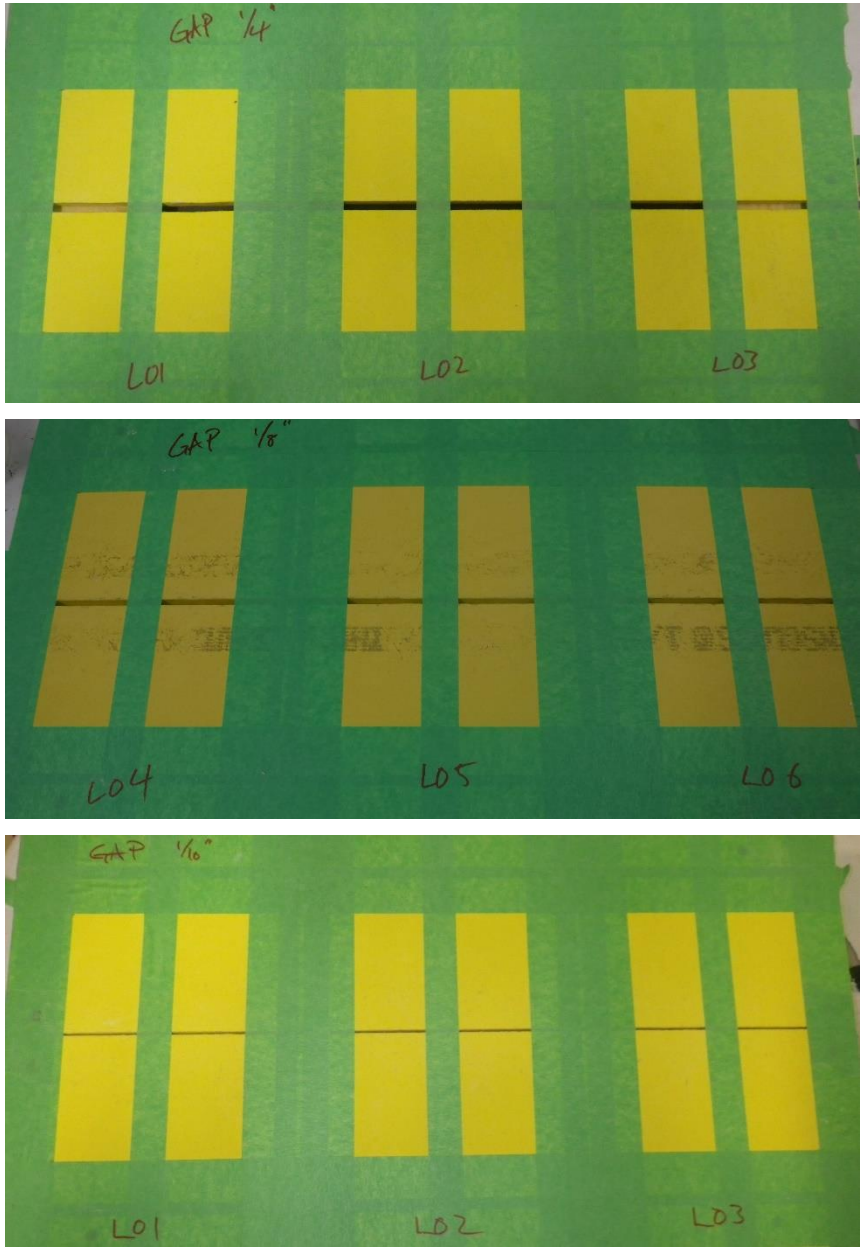
Window mock-up drying – Results



Gap Bridging Ability

Gap Bridging Ability

- → Test consisted of applying the membrane to substrate with different gap widths and evaluating bridging ability.
- → Three gap widths: 1/4”, 1/8” and 1/16” were created using factory edge of gypsum sheathing
- → Monitored over 72 hours for formation of pin holes and voids (often not visible/apparent immediately)

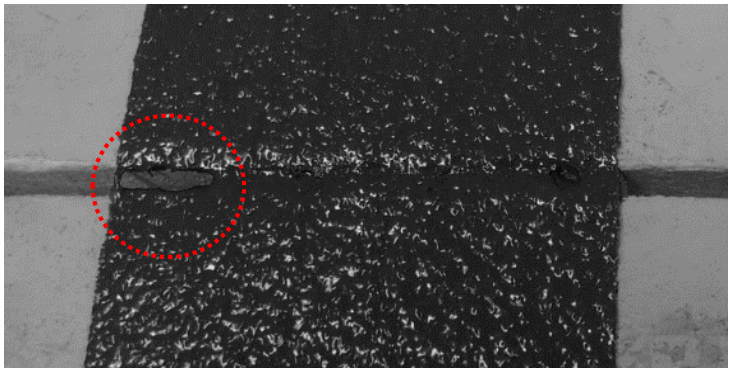


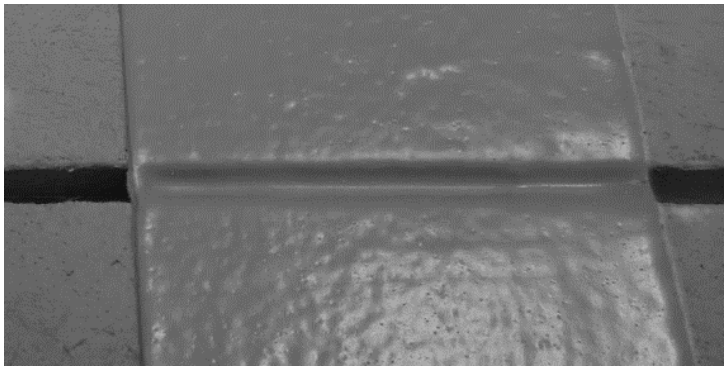
Gap Bridging Ability

Gap Bridging Test Results after 72 Hours

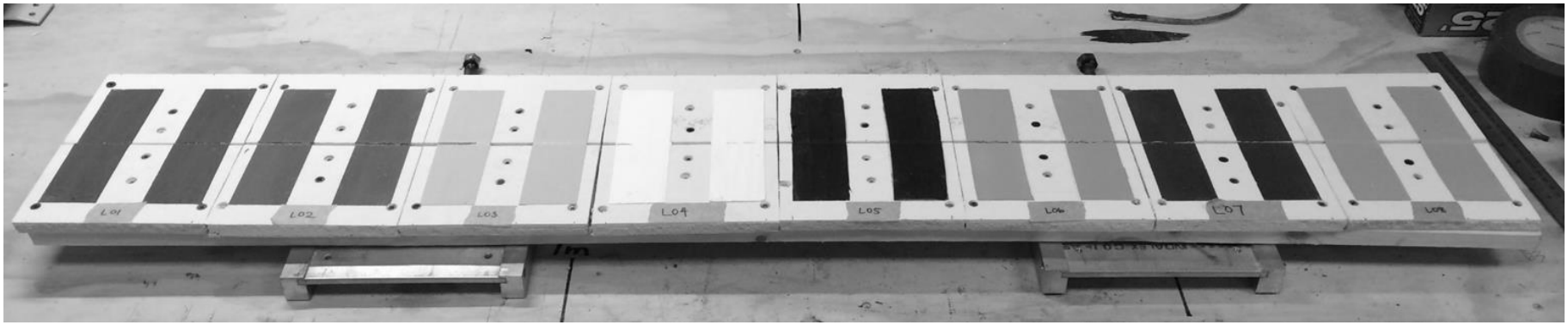
Sample ID	Chemistry	Thickness (wet mils)	1.6mm (1/16”) Gap	3.2mm (1/8”) Gap	6.4mm (¼”) Gap
L01	STPe	15 mils	FAIL	FAIL	FAIL
L02	STPe	15 mils	FAIL	FAIL	FAIL
L03	Silicone	30 mils	FAIL	FAIL	FAIL
L04	STPe	25 mils	BRIDGED	BRIDGED	FAIL
L05	Silicone	65 mils	BRIDGED	BRIDGED	BRIDGED
L06	STPe	15 mils	BRIDGED	FAIL	FAIL
L07	Acrylic	48 mils	FAIL	BRIDGED	FAIL

Note: All specimens applied at manufacturer’s specified thickness.



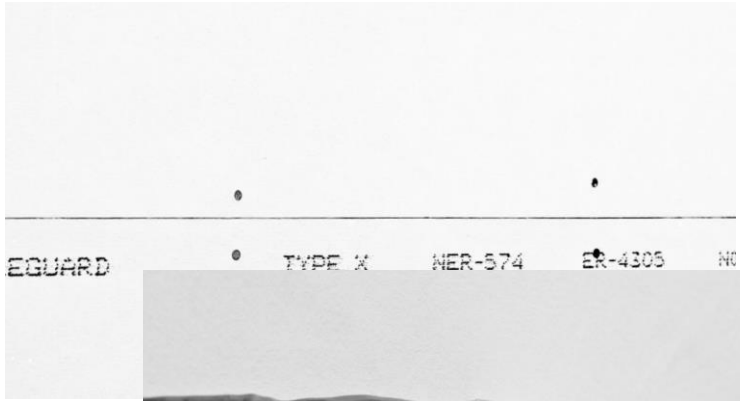


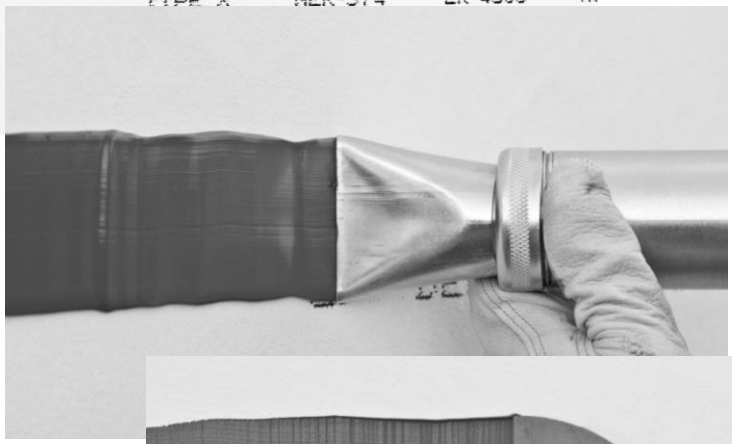
Gap Elongation – From Zero to >1/16” Opening

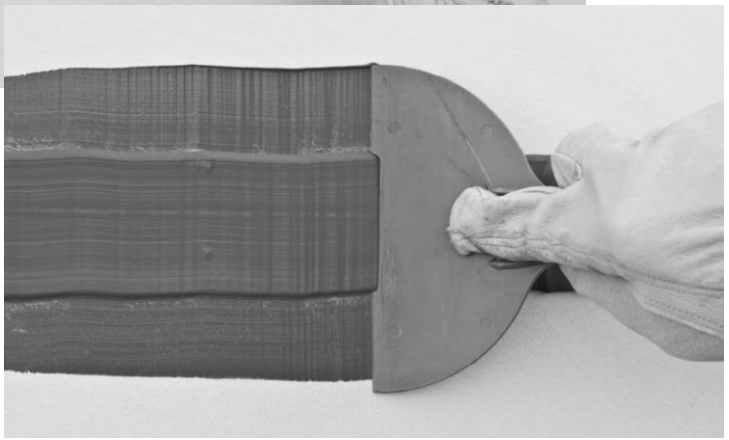


Sample ID	Widen to 1/16”	Close to 0”	Widen to 1/8”	Close to 0”	Widen to 1/4”	Close to 0”	Widen to 1/2”
L01	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
L02	BRIDGED	BRIDGED	FAIL	FAIL	FAIL	FAIL	FAIL
L03	BRIDGED	BRIDGED	FAIL	FAIL	FAIL	FAIL	FAIL
L04	BRIDGED	BRIDGED	FAIL	FAIL	FAIL	FAIL	FAIL
L05	BRIDGED	BRIDGED	BRIDGED	BRIDGED	BRIDGED	BRIDGED	BRIDGED
L06	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
L07	BRIDGED	BRIDGED	BRIDGED	BRIDGED	BRIDGED	FAIL	FAIL

Joint treatment critical with liquids







Conclusions

- → Preliminary results confirmed common industry assumptions
  - → Plywood and OSB more susceptible to moisture uptake and decay
  - → Self-adhered membranes performed as expected
- → Potentially some liquid chemistries acceptable as sill flashings
- → Thicker membranes exhibited better gap bridging capabilities, but all membranes still require reinforcement across gaps/cracks
- → No discernable drying benefit to liquids over impermeable self-adhered products
- → Development of new ASTM or AAMA test methods required to reflect in situ performance of liquids in flashing application

Discussion + Questions

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→ www.rdh.com

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