Envelope Moisture Management for an Affordable Housing High Rise

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High Performance Building Solutions

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HIGH PERFORMANCE BUILDING SOLUTIONS

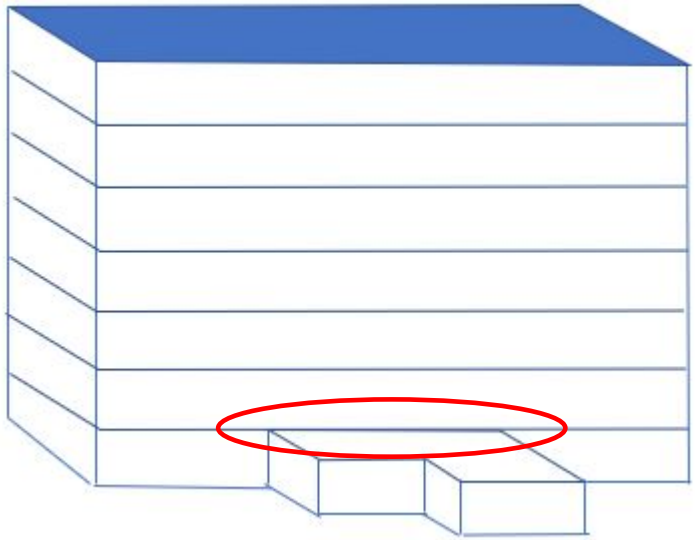
Learning Objectives

1. Forensic Moisture Assessment of an Existing Building Envelope
2. Importance of Design Review and Mockup Testing for Existing Building Retrofits
3. Key Moisture Management for PTAC systems

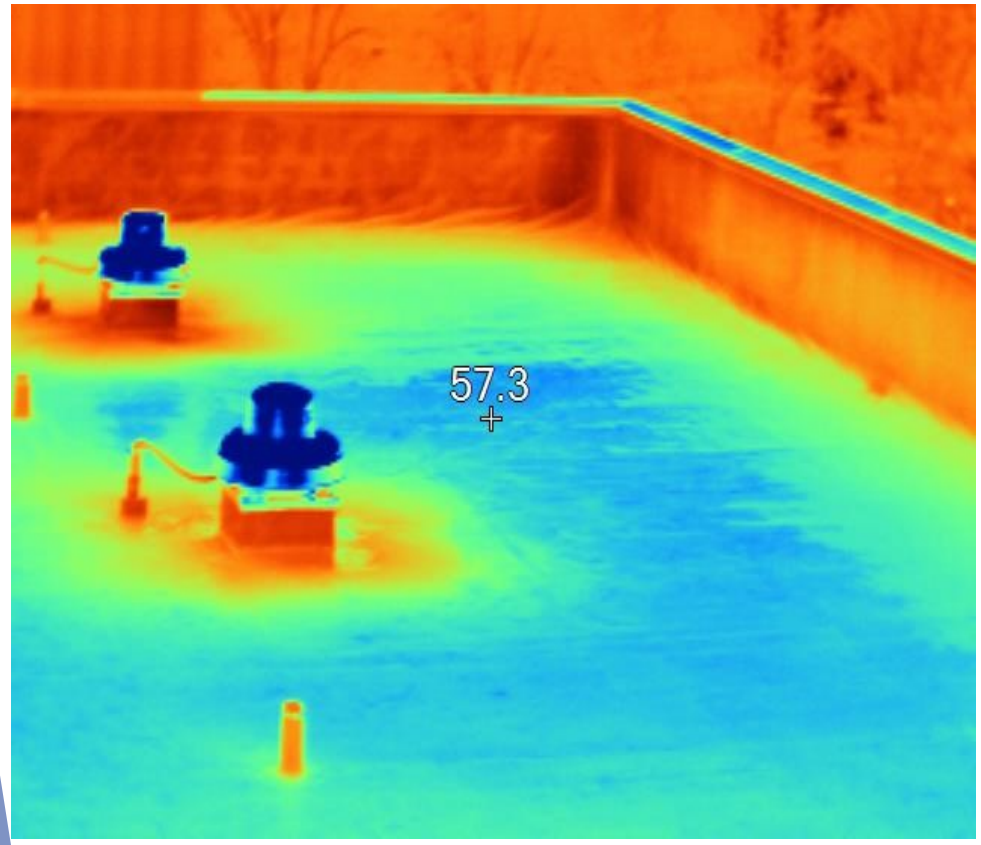
Forensic Moisture Assessment of an Existing Building Envelope

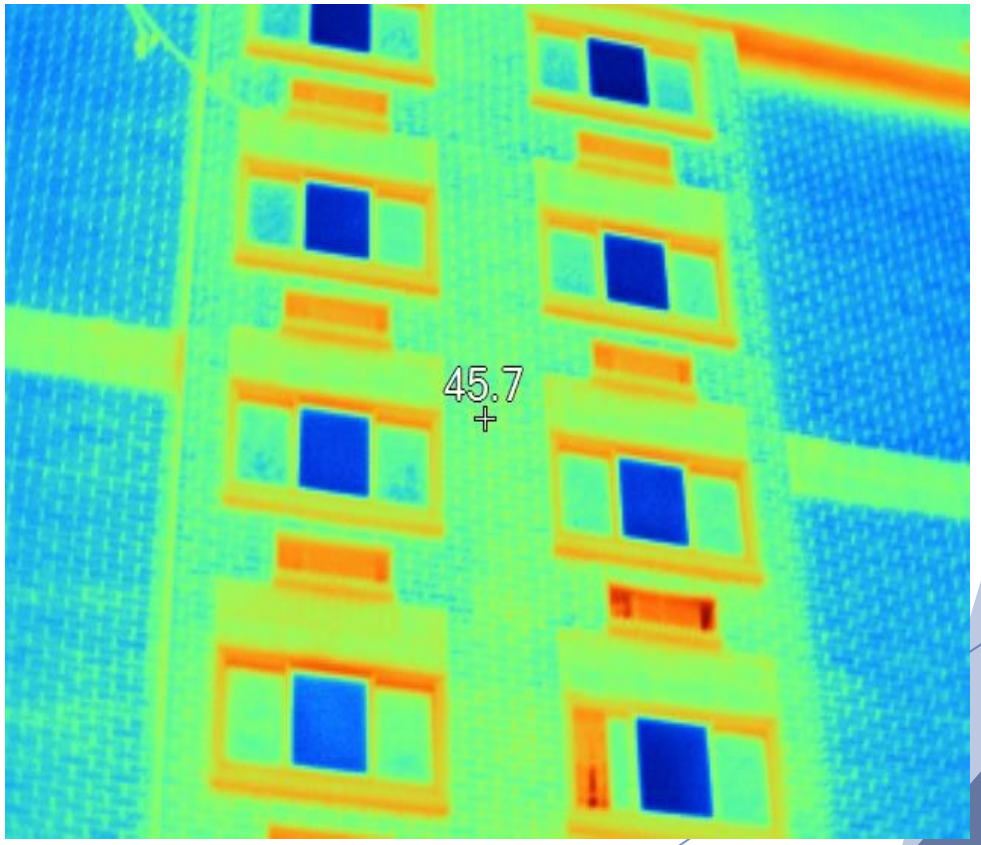
Built in 1980
7-stories with 1 story Community area.

Leaks at intersection



Roof Thermography Inspection





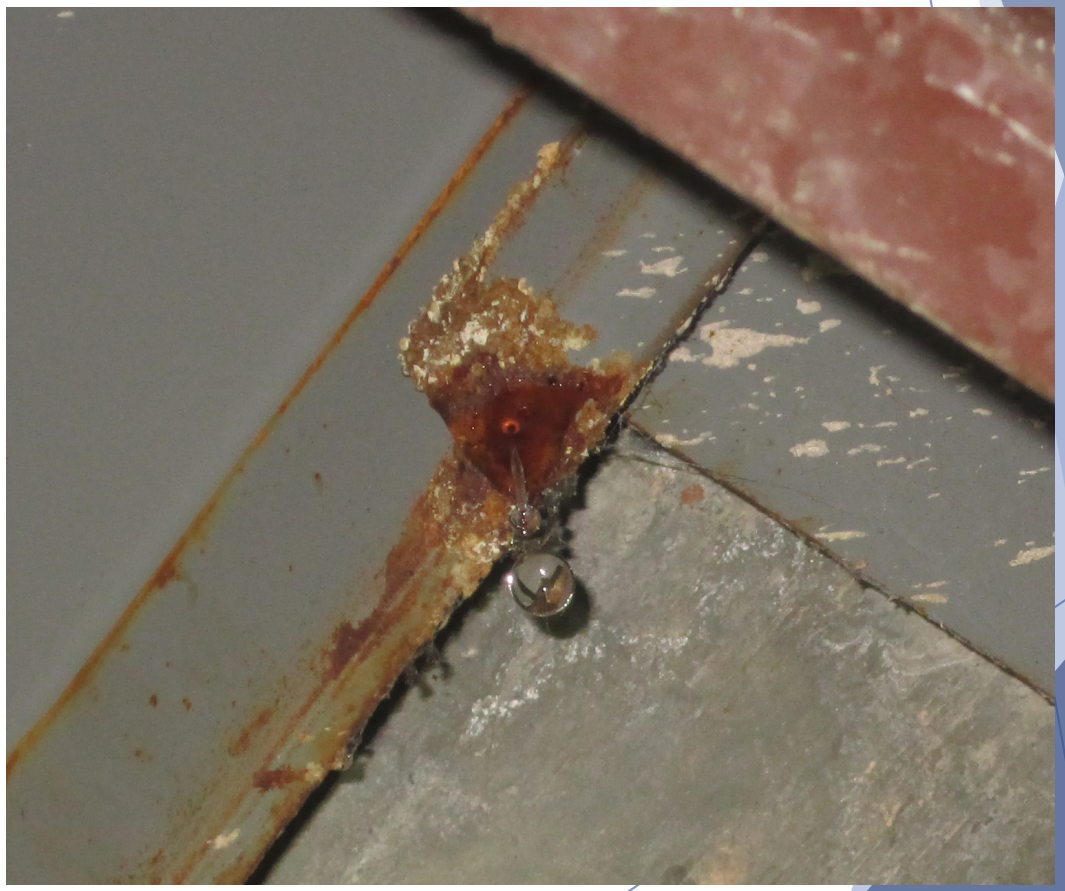
Inside Inspection

Outside Inspection
PTAC sleeve terminates inside wall

Outside Inspection -Detail

Water Test – DIY Spray Rack

Inside Re-Inspection
Leaks observed when spraying PTAC



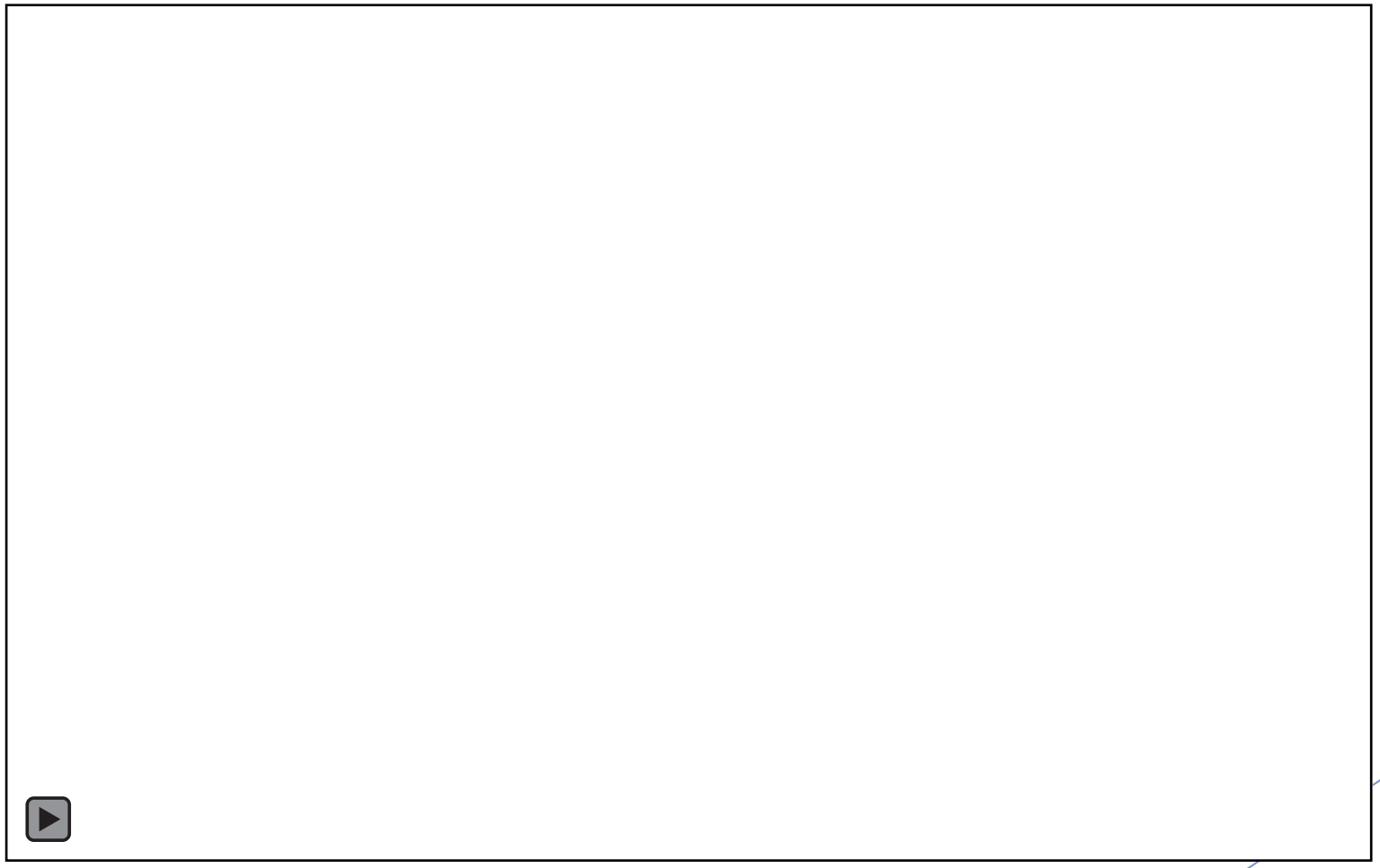
Outside Re-Test
Temporary seal up PTAC & exclude window – Still leaks!

Outside Test Again – Window

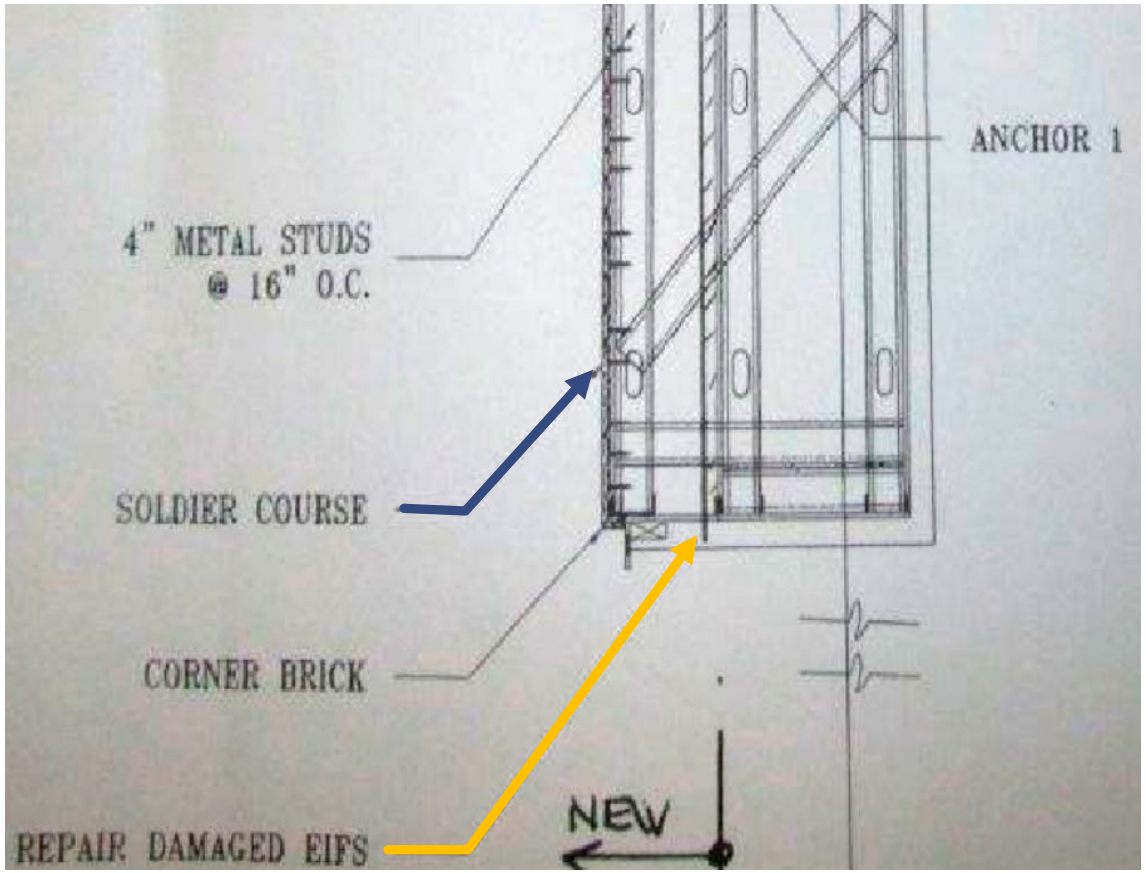
Window-Only Leaks

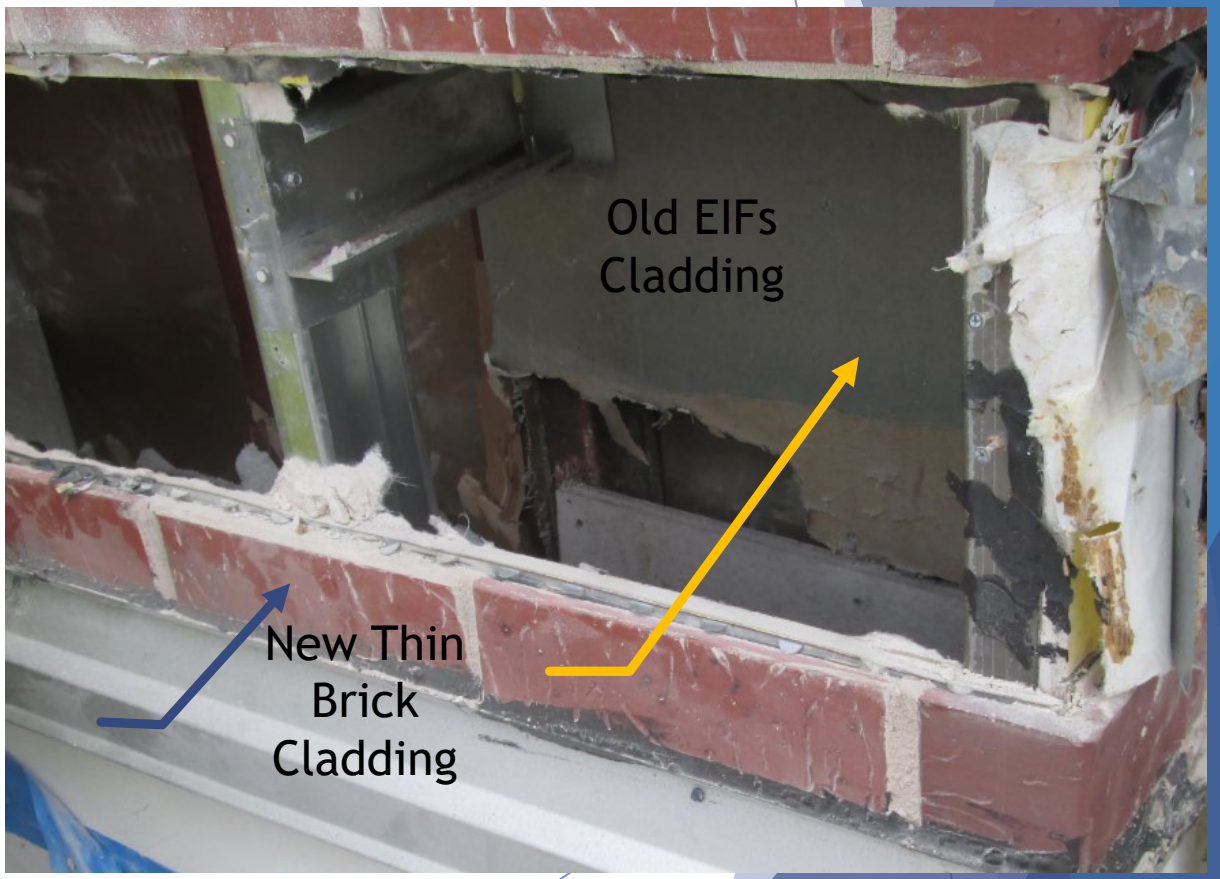
Additional Information:
Thin brick cladding? Original stucco cladding?

Test Thin Brick Clad Wall – It Leaks Too



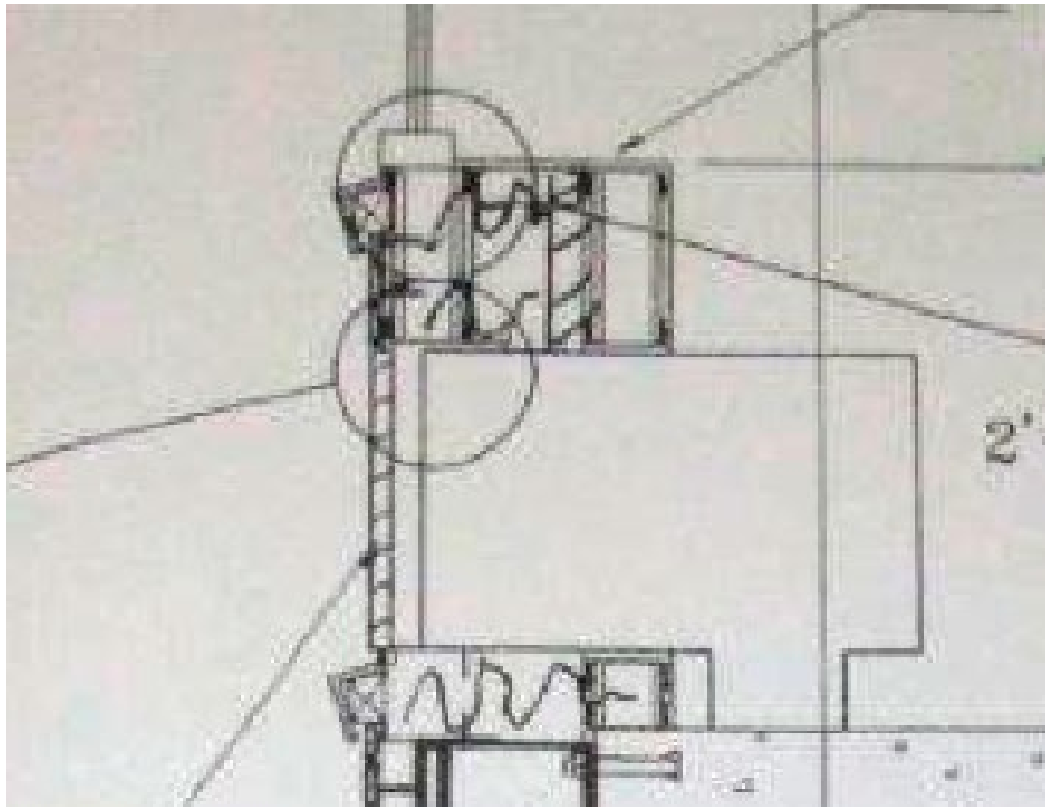
Review Plans – Conduct Invasive Inspection
PTAC, windows, two cladding systems all leak





Repair Requires Removal and Recladding
Manage moisture with a drainage shelf

Mock Up PTAC Repair
Sleeve to extend beyond the wall



PTAC repair - Mock Up

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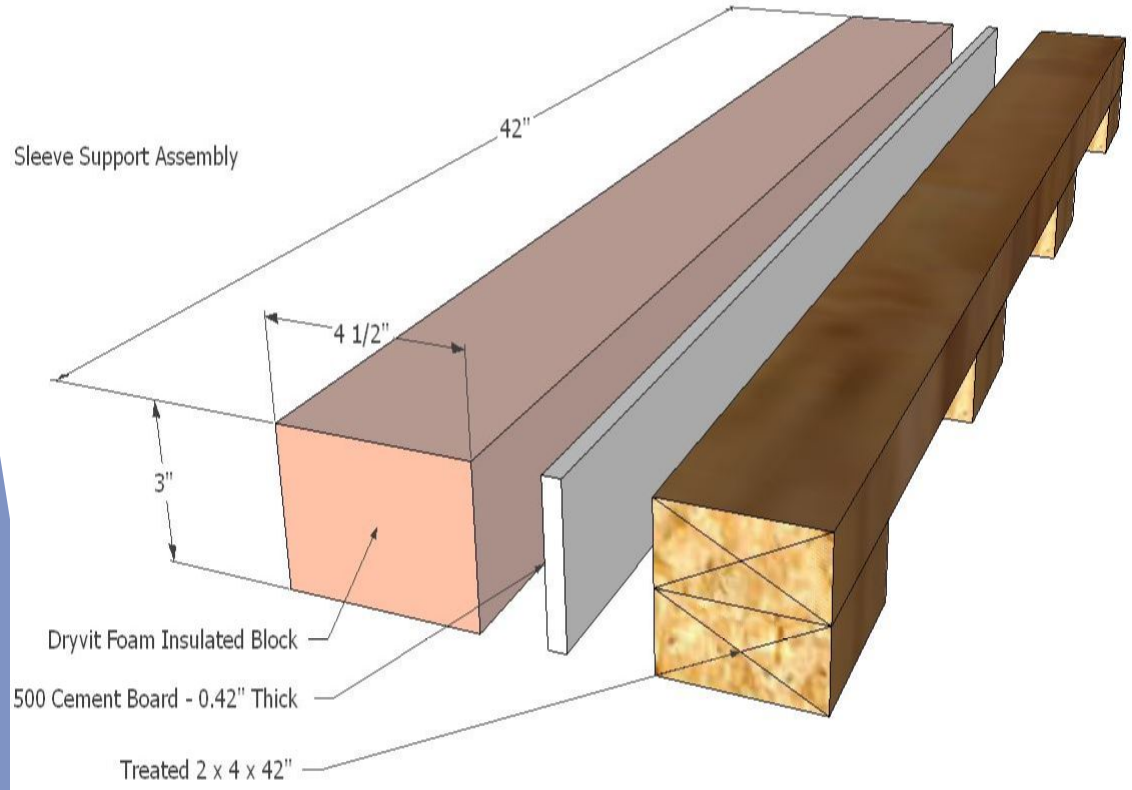

PTAC repair - Mock Up Testing

Thank You

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Bonus Round

Case Study 2: Wet Walls Research Lab

Research Lab Building

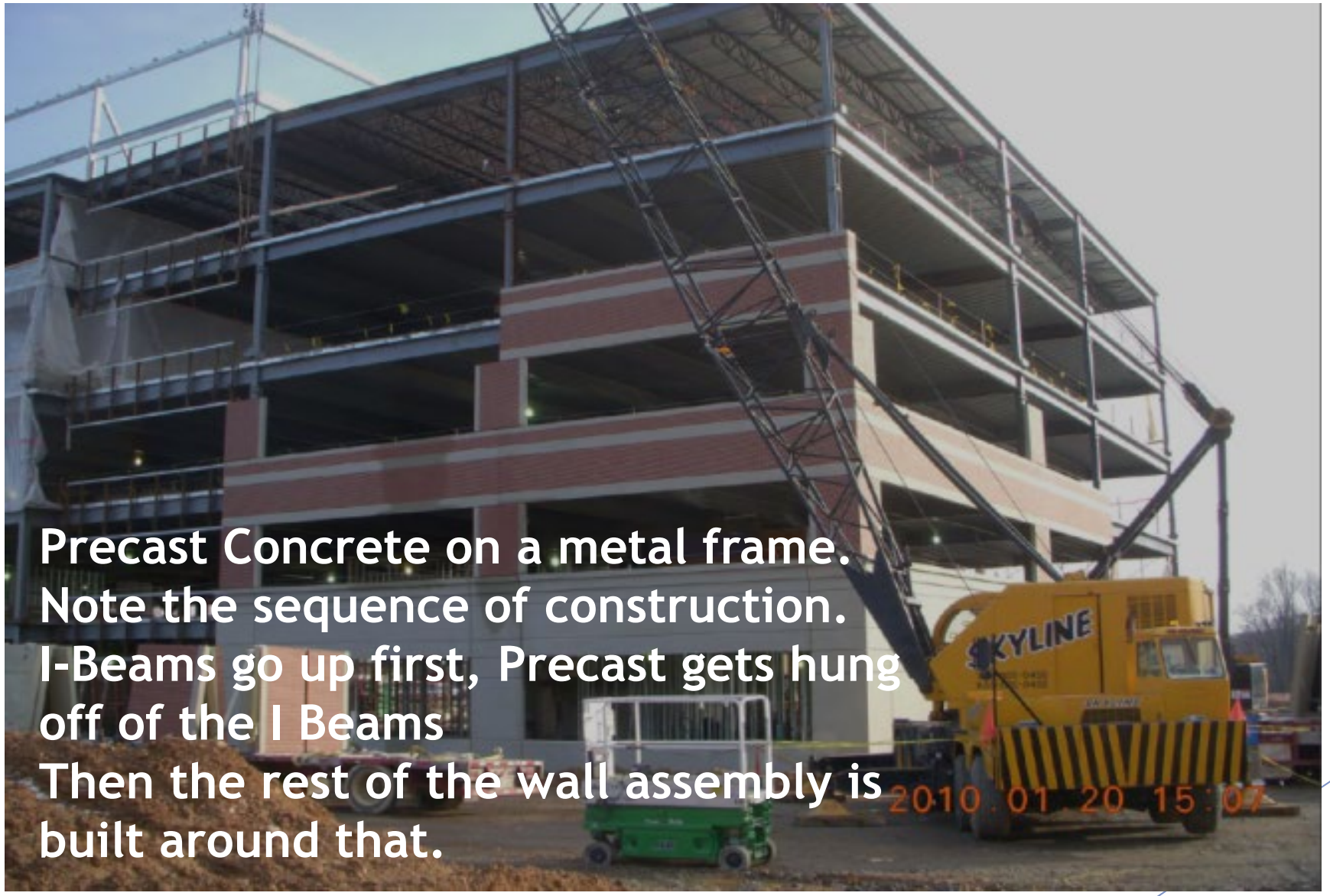
University owned Research facility High comfort office space for 500 staff

Laboratory in core with precise climate control

Electrostatic discharge controls

Located in a cold climate

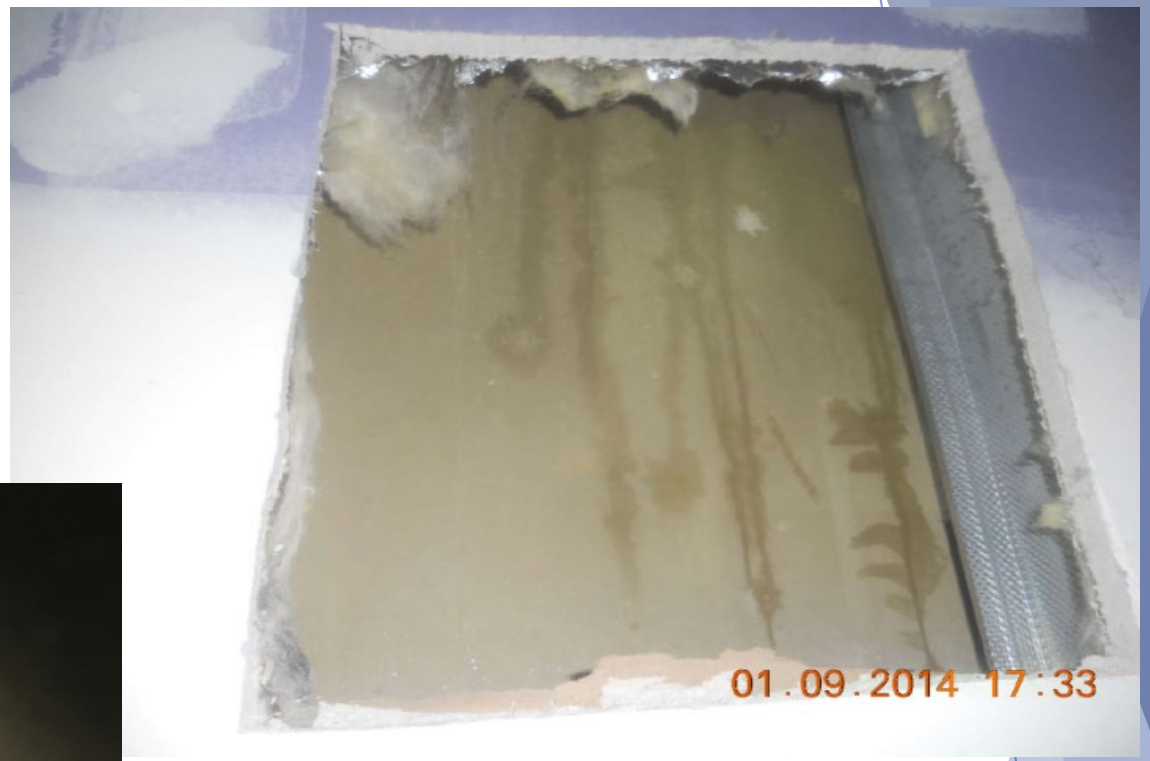
High performance building = LEED Gold 2012



Precast Concrete on a metal frame.
Note the sequence of construction.
I-Beams go up first, Precast gets hung off of the I Beams
Then the rest of the wall assembly is built around that.

Here are some pictures of the walls with the gypsum and insulation cut away.

On cold days water Condensed on the precast concrete walls and dripped down –



On really cold days moisture Froze on the precast concrete walls and built up for several days until a warm spell melted it all at once.

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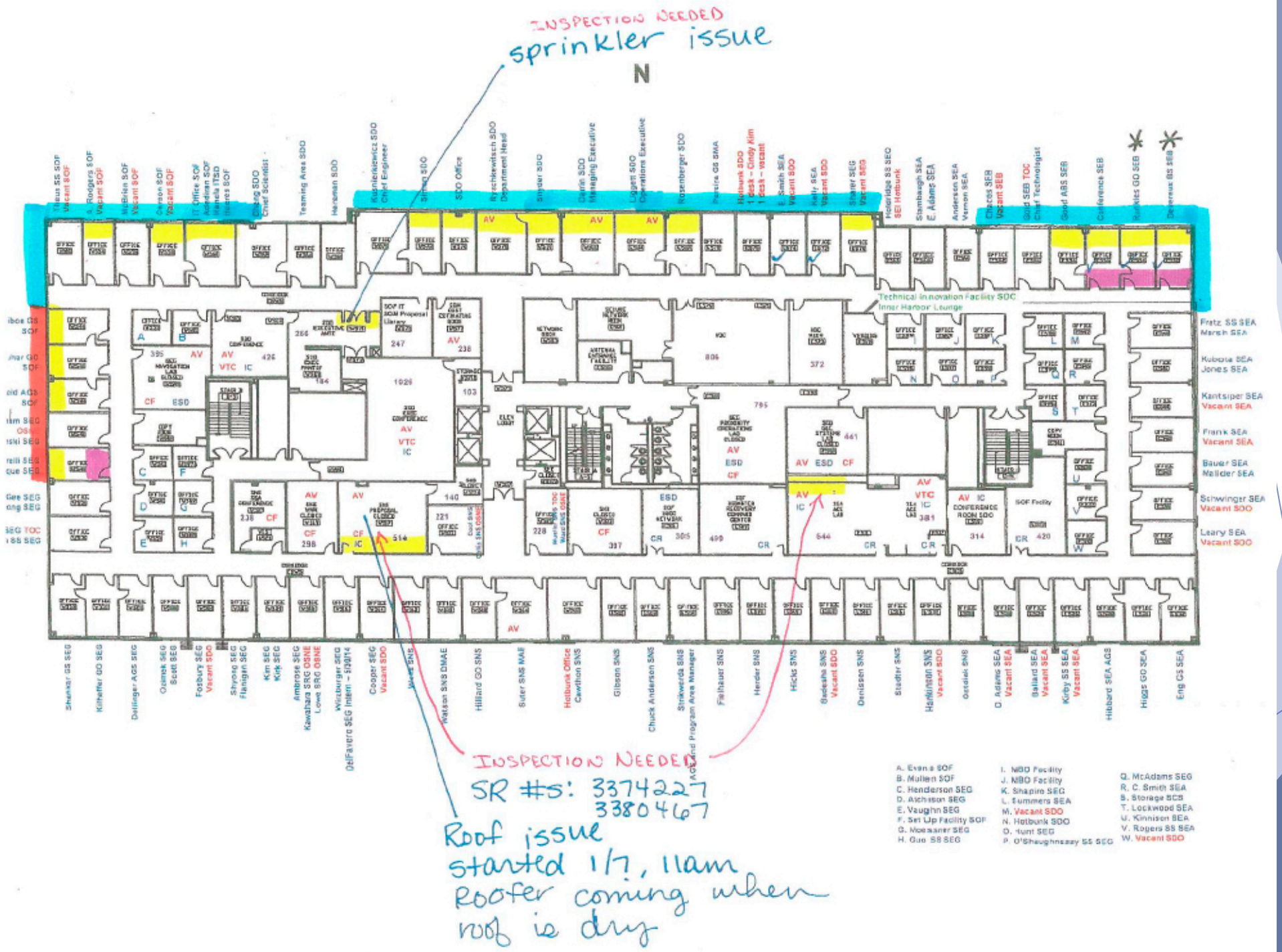
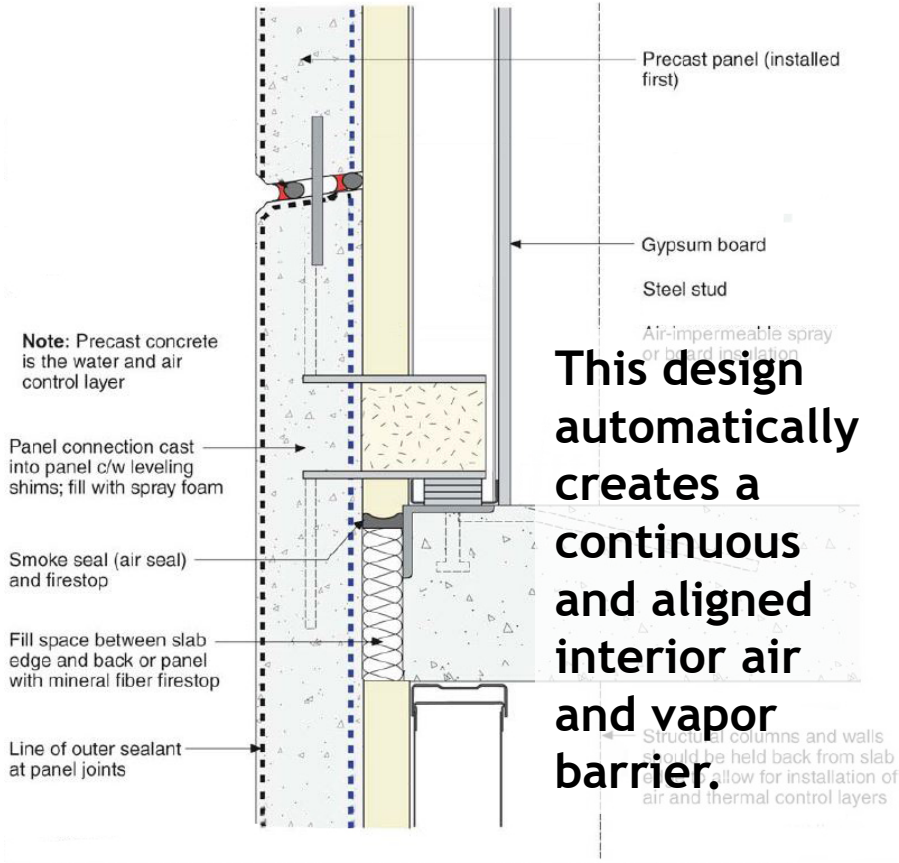
If the dripping walls were over windows this created water bubbles under the paint at the window head (15% of offices) - which then would burst and drip water all over the papers piled up on the window sills.

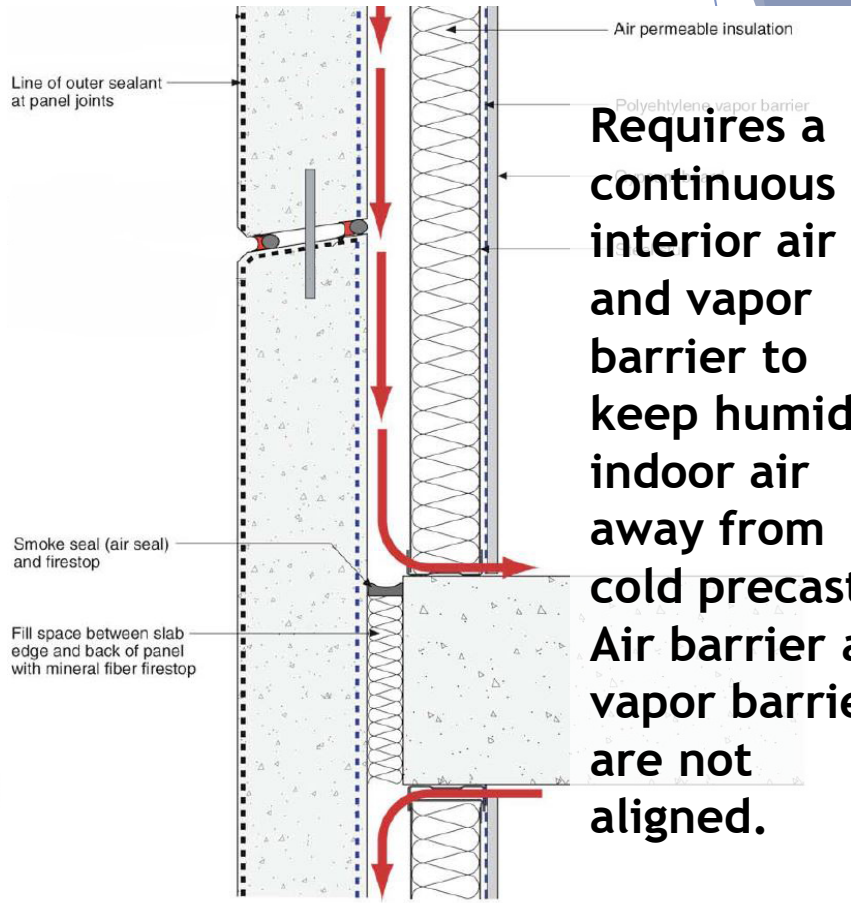

INSPECTION NEEDED
sprinkler issue
N
INSPECTION NEEDED
SR #s: 3374227
3380467
Roof issue
started 1/7, 11am
Roofer coming when
roof is dry

Two Precast Concrete Wall Designs



Low Risk Wall–Impermeable face-sealed cladding ("perfect barrier") that is internally insulated with air impermeable insulation. Typically spray applied 2 lb/ft^3 (0.91 kg/m^3) polyurethane foam or rigid foam board directly adhered to the backside of the exterior cladding with all joints sealed.

This design automatically creates a continuous and aligned interior air and vapor barrier.

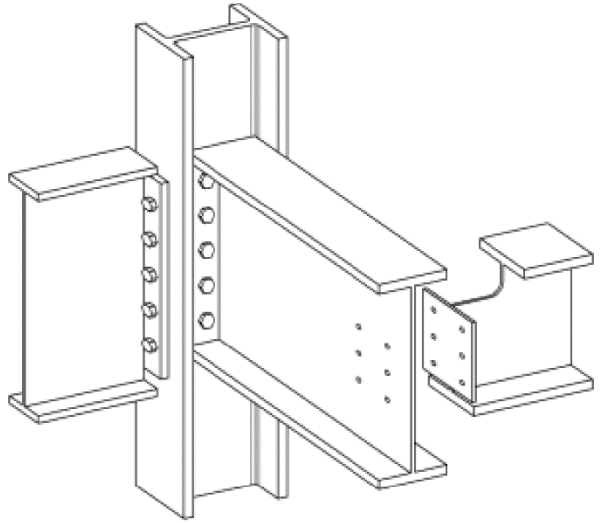


Failure Mode–Convective looping of interior air between the interior and the interstitial cavity existing between the back of the cladding and the interior gypsum board lining leading to condensation, corrosion, mold, odors and generally bad things.

Requires a continuous interior air and vapor barrier to keep humid indoor air away from cold precast. Air barrier and vapor barrier are not aligned.

Could have easily installed rigid board or SPF during construction

The second design is very difficult to build. How do you tape foil faced insulation behind and around the I-Beams to make a continuous vapor or air barrier?



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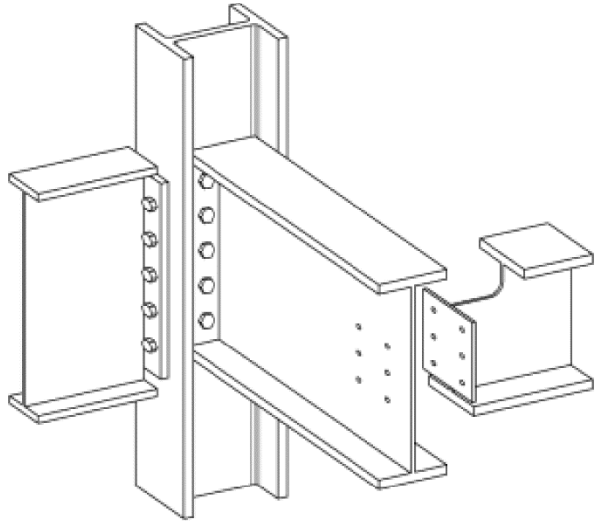
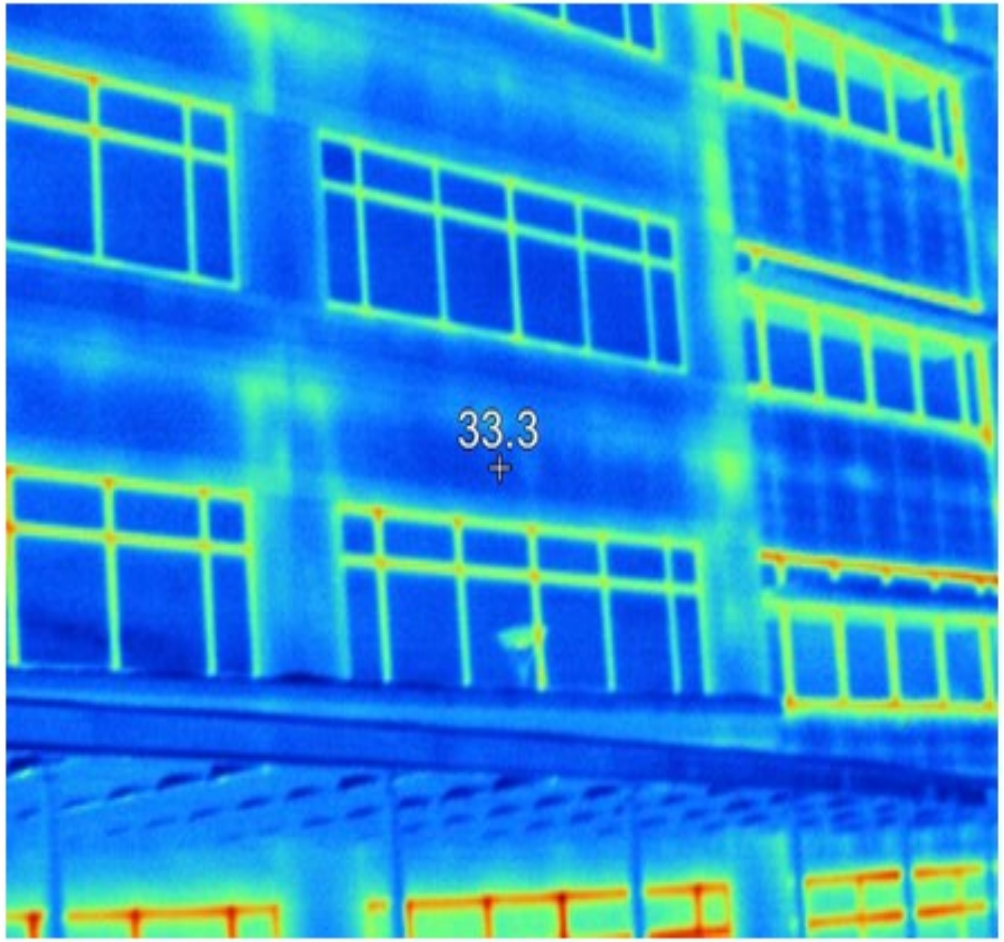
Usually what happens:





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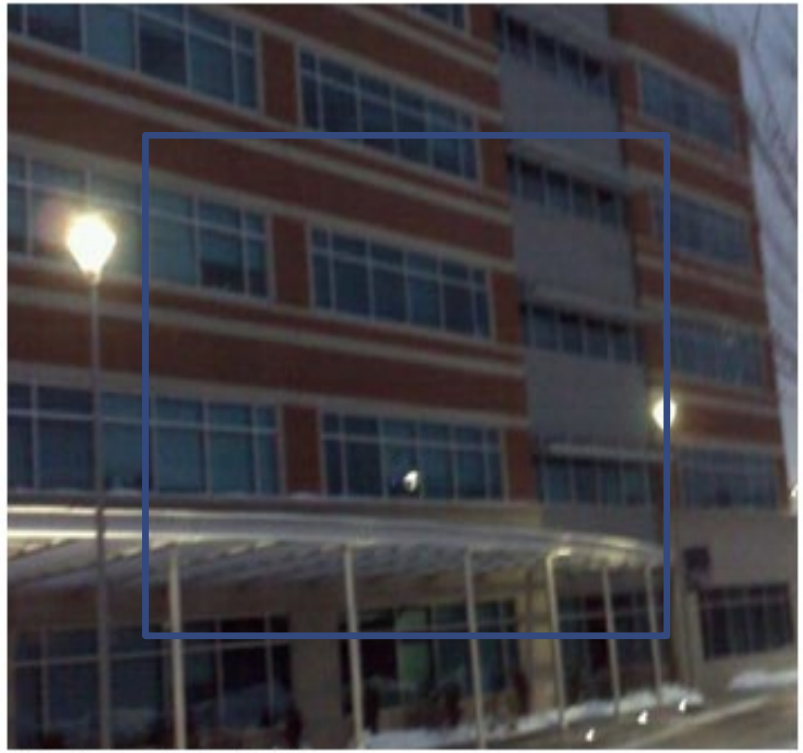
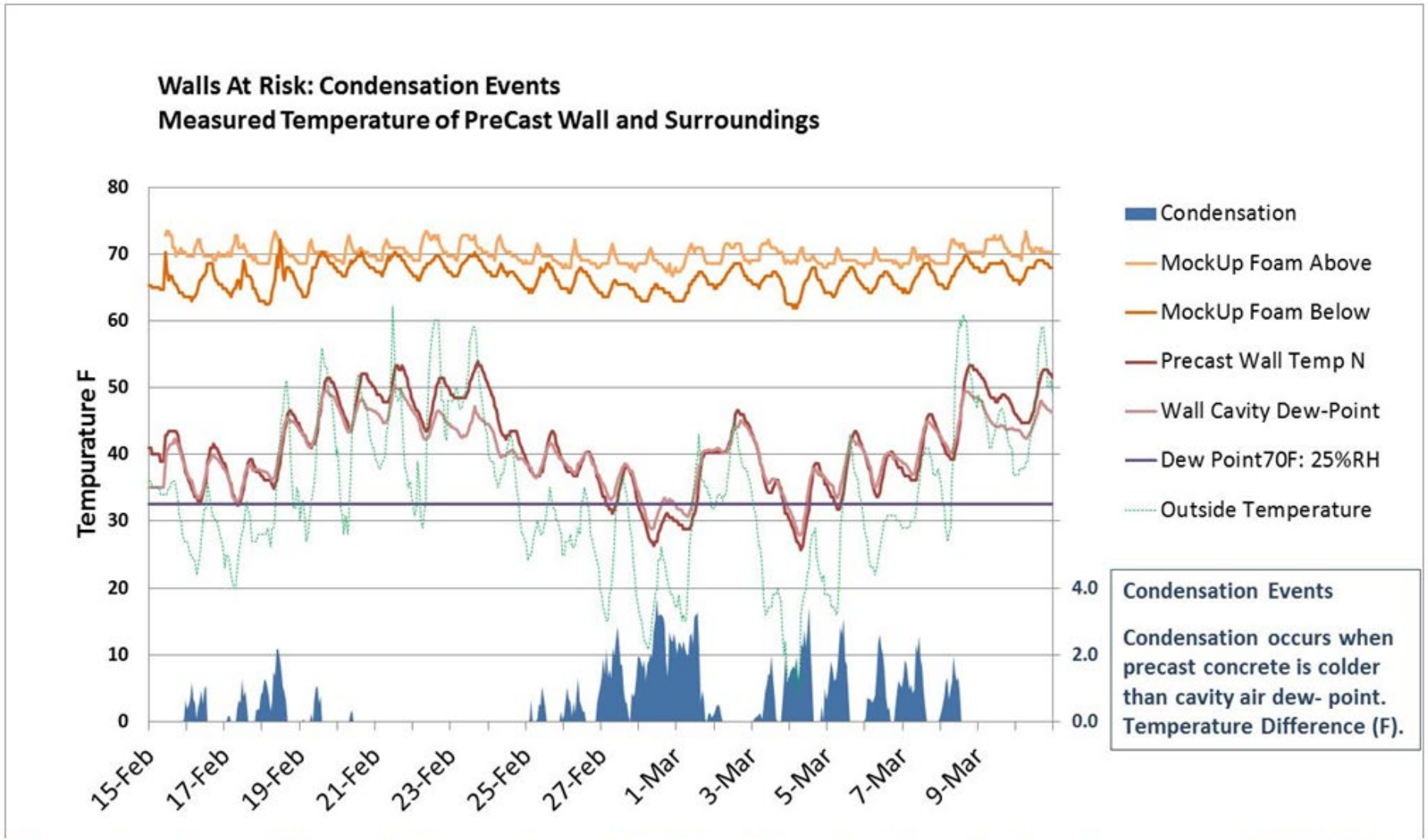


Visible Light Image

IR photos show heat signatures along the hard-to-reach I-beams areas illustrating where air leakage into the wall assembly is occurring.

Reinsulate and monitor for the repair mock-up

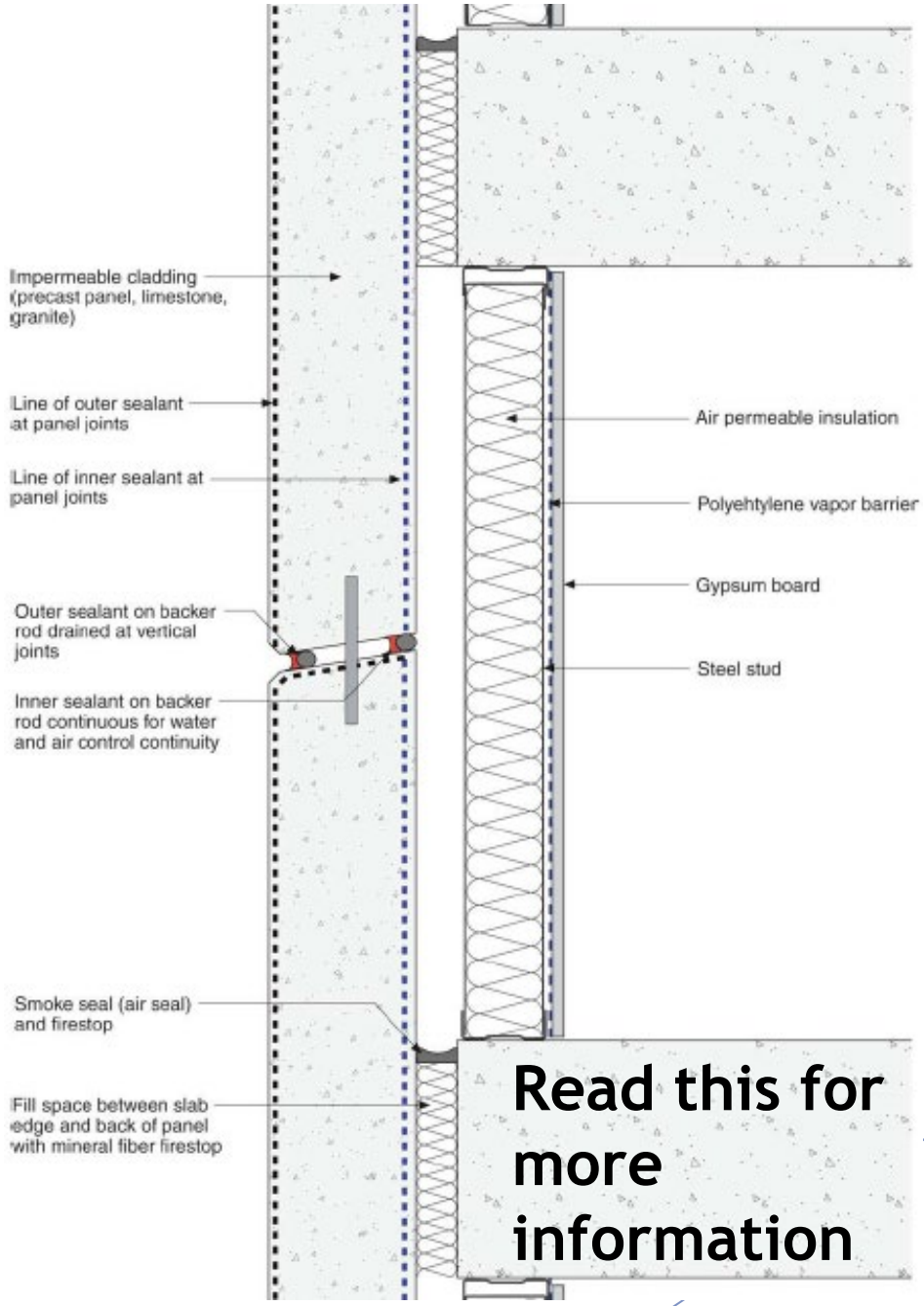


Measured surface and dew point temperatures in wall cavities. Condensation occurred 46% of the time. The average precast temperature when condensation occurred was 36F; the highest precast temperature when condensation occurred was 47F.

Insight Risky Business: High Risk Walls

An edited version of this Insight first appeared in the ASHRAE Journal.

By Joseph W. Lstiburek, Ph.D., P.Eng., Fellow ASHRAE



Read this for more information

Thank You Again!

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