BUSQUE ENGINEERING LTD.
Building Envelope and Roofing Consultants

HISTORICAL BUIDING RESTORATION

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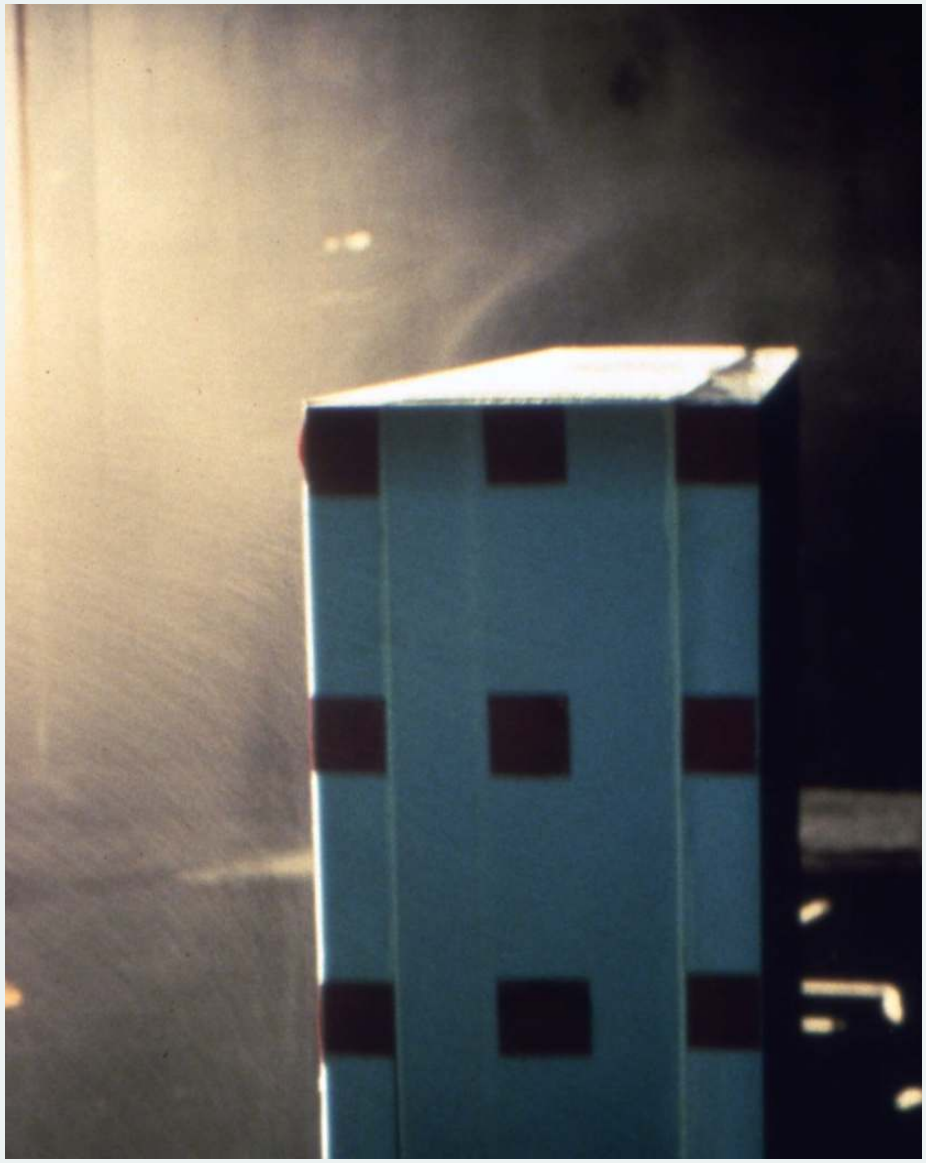
Case Studies

1. Boeing's Original Manufacturing Plant
2. 80 year old school of theology
3. 80 year old Church
4. 100 year old residential building
5. 100 year old school
6. 120 year old Gulf of Georgia Cannery

Impetus for Restoration

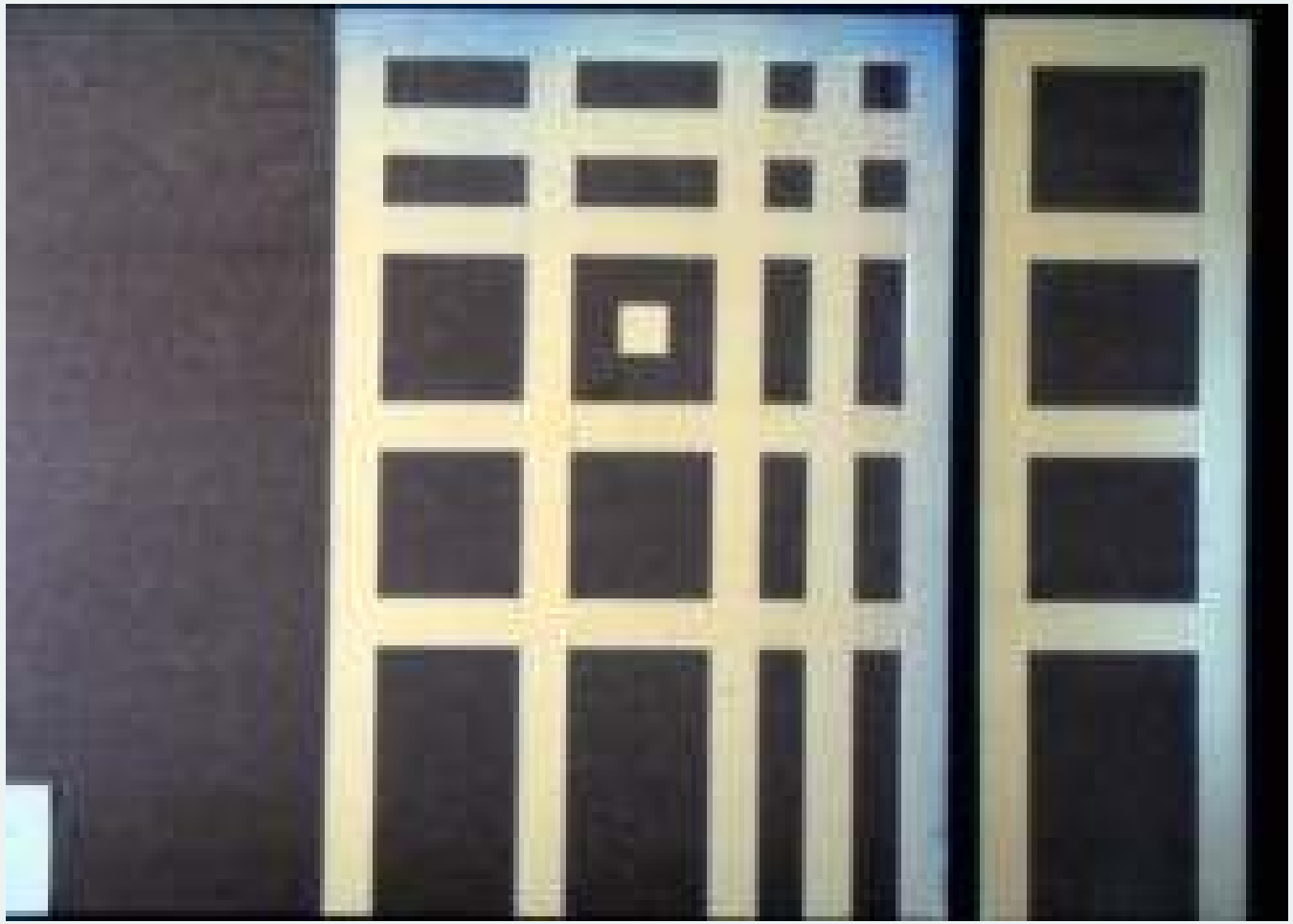
- Functionality (building no longer performs)
- Structural, Water Penetration, Thermal…
- Preservation

CMHC Wind Driven Rain Study 1994



Wind tunnel testing

Modeled the wetting patterns of a building.



Wind tunnel testing

Wetting pattern is distinct

Dark areas are saturated

National Research Council Library Ottawa

Architectural features were for more than just looks.

These helped the façade to shed water

Confederation Building Vancouver

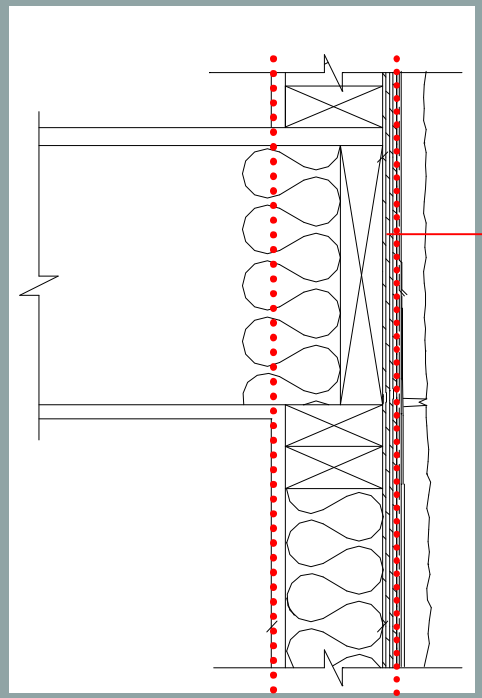
The Sun Tower


6/11/04 10:30am

Boeing Plant Seattle, WA

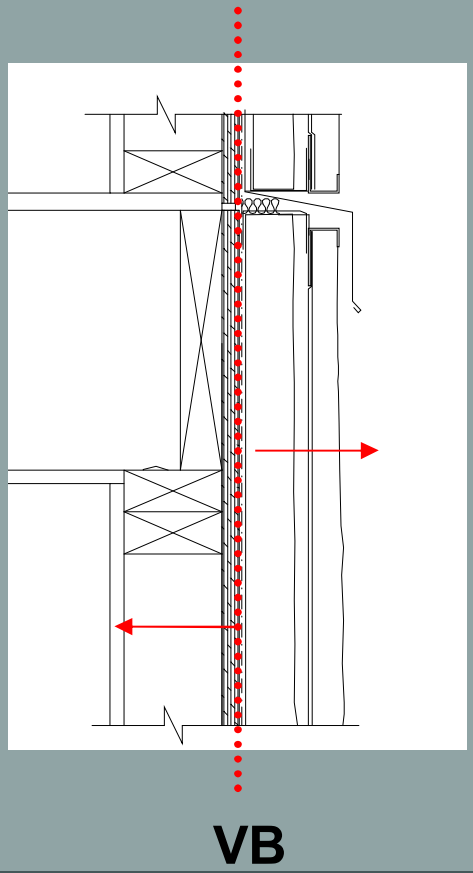
Types of Assemblies-Moisture

Accumulators: failures tend to be more drastic



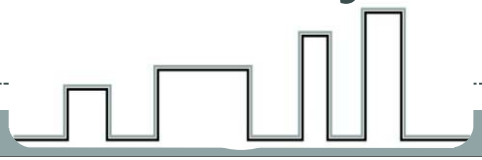
Accumulator: water enters more easily than it can escape

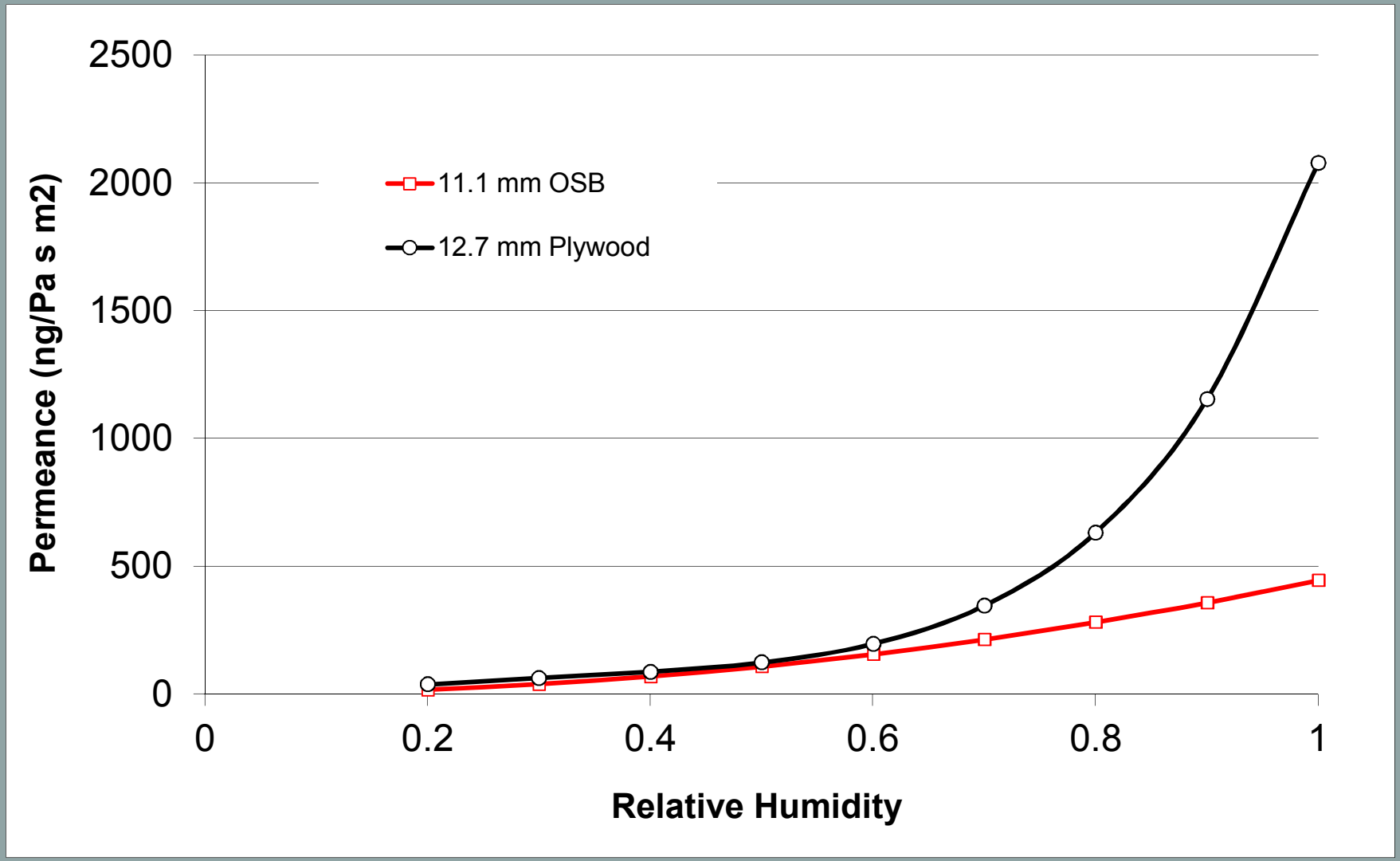
Dissipaters: failures tend to be more localized



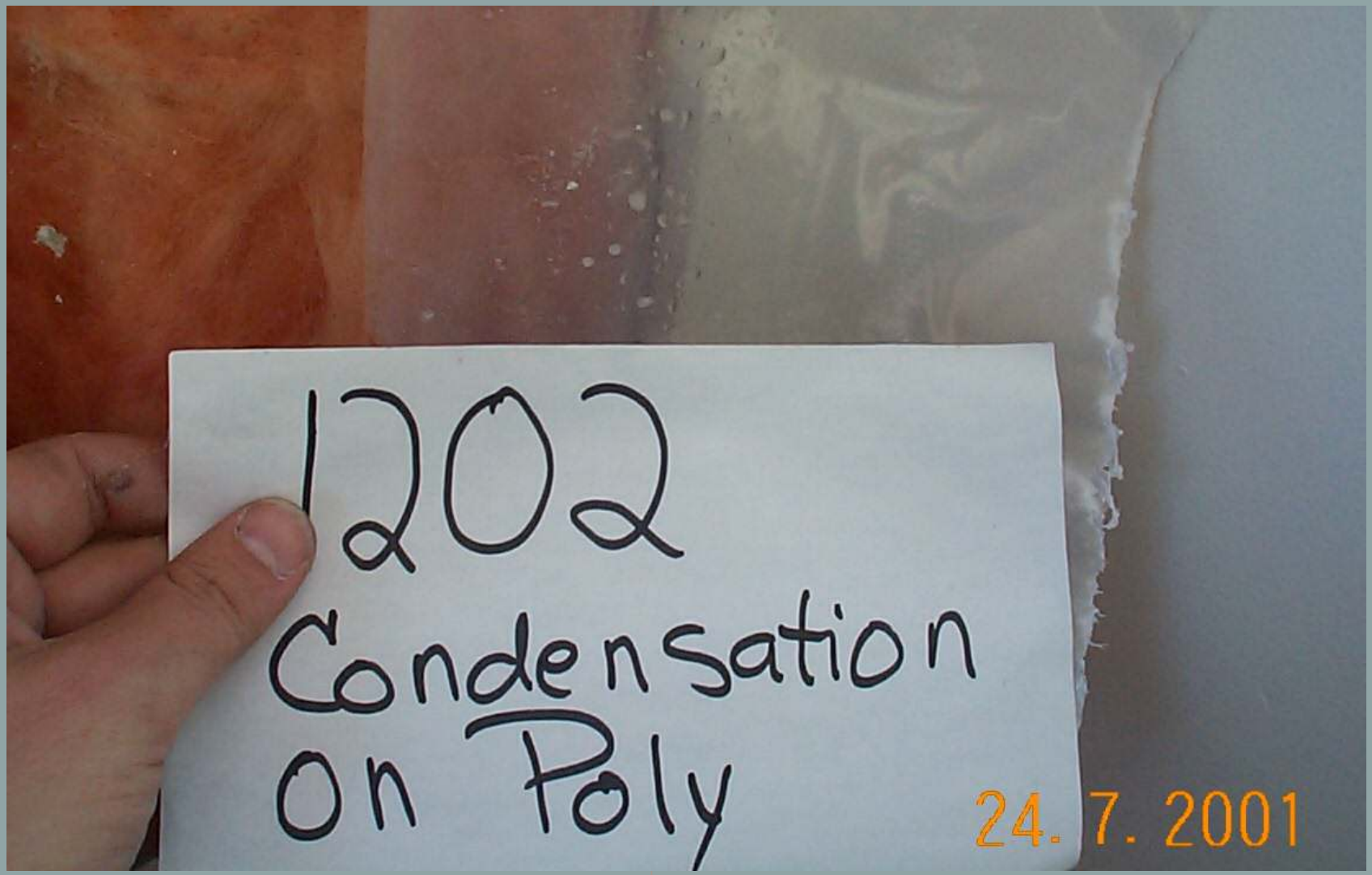
Dissipater: water is not stored easily in the assembly

OSB vs. Plywood





BEWARE OF NEW THINGS IN OLD WALLS!!!!



PUR PERMEANCE IS A CLOSE MATCH FOR THAT OF CONCRETE

Russian Submarine

Circa 1912

Occupant tired of being cold in winter

No leaks reported inside

What We Did

1” EPS insulation, applied to brick

Paperless gypsum board

No complaints after 8 years

80 Year old Church

Client wants to

- insulate walls
- stop leakage inside

Our Response

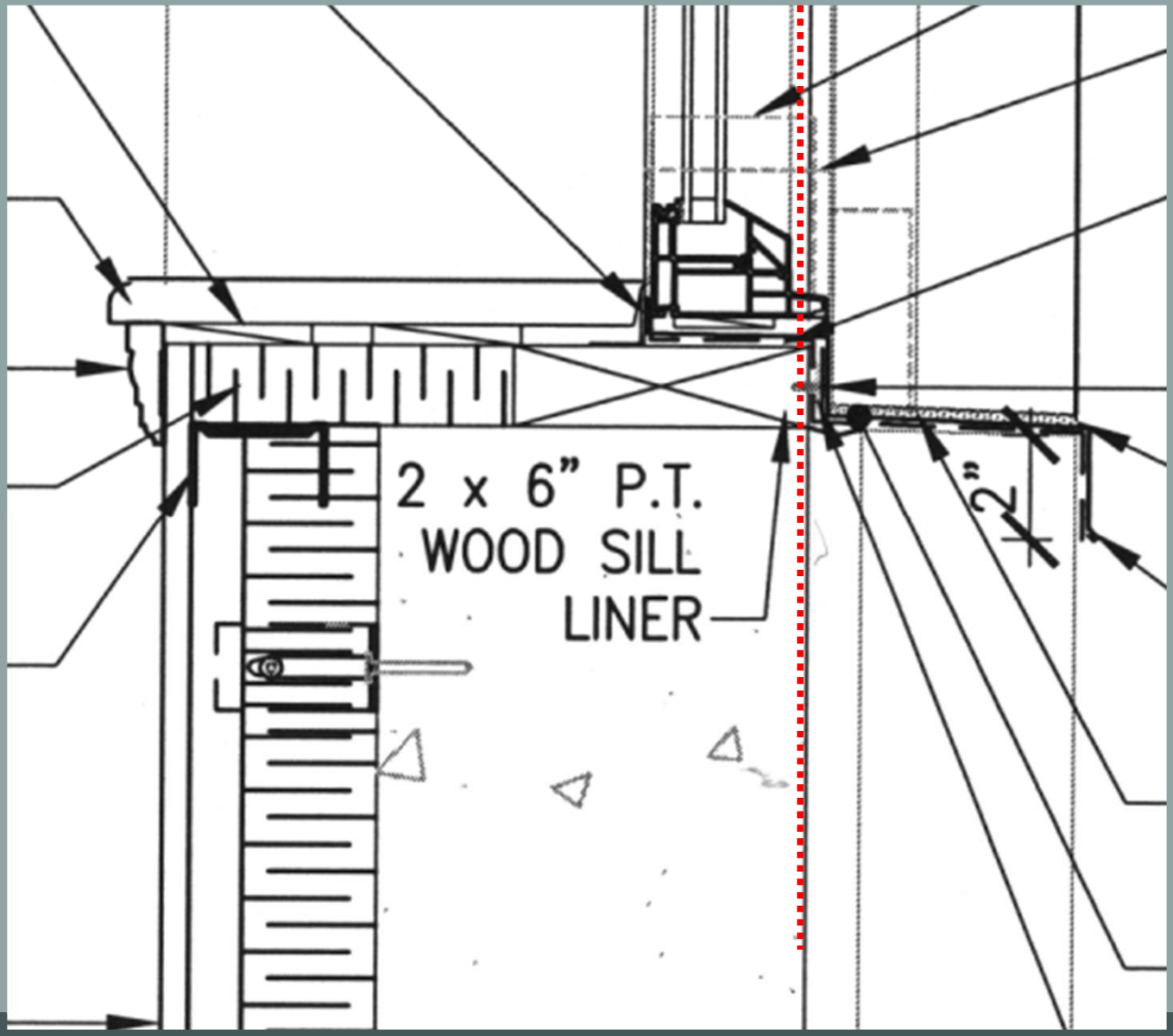
Leakage too severe to insulate.

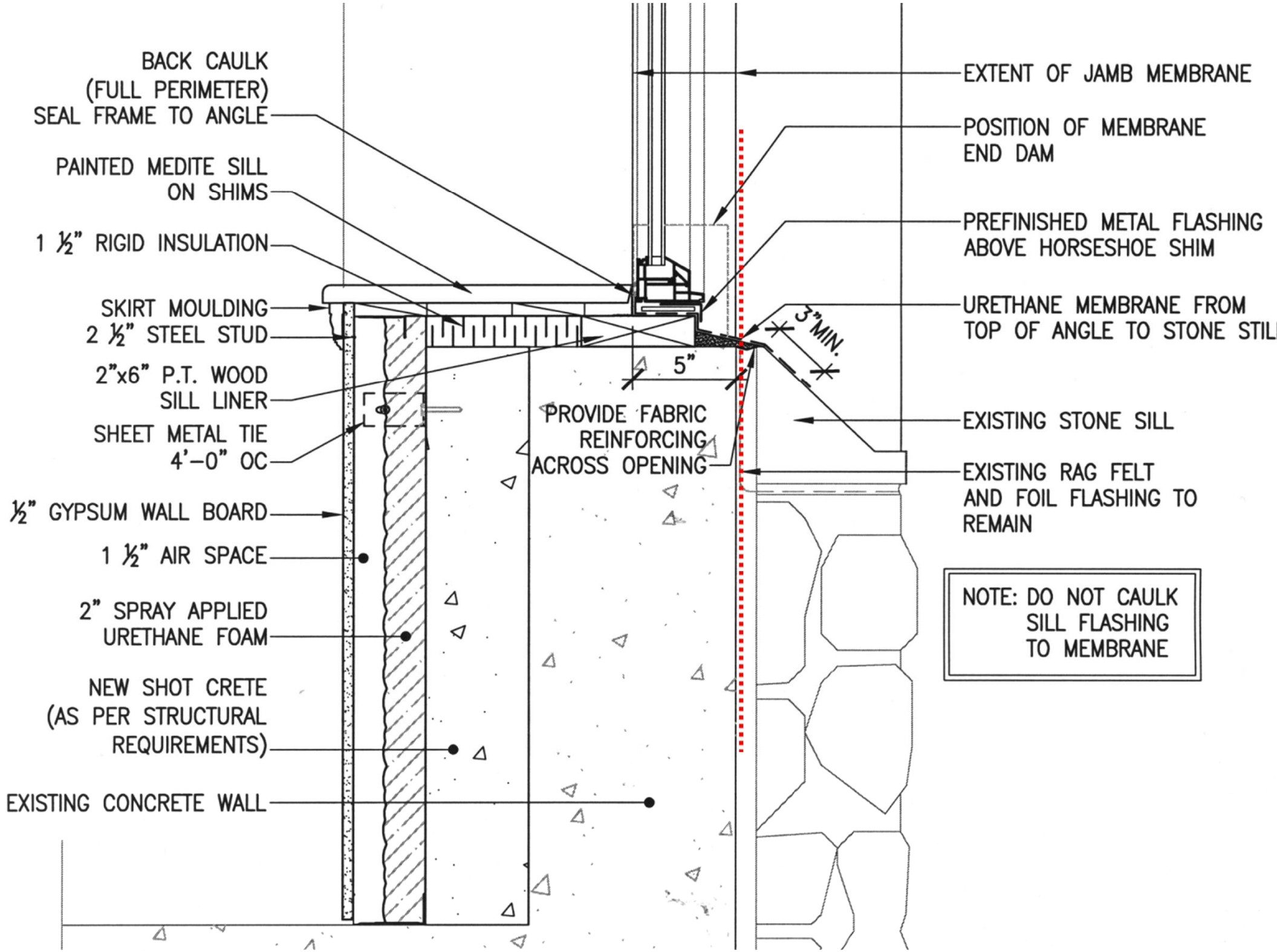
80 year old school

Windows had a waterproofing liner below them.

Windows (had a waterproofing liner below)

Original window detail



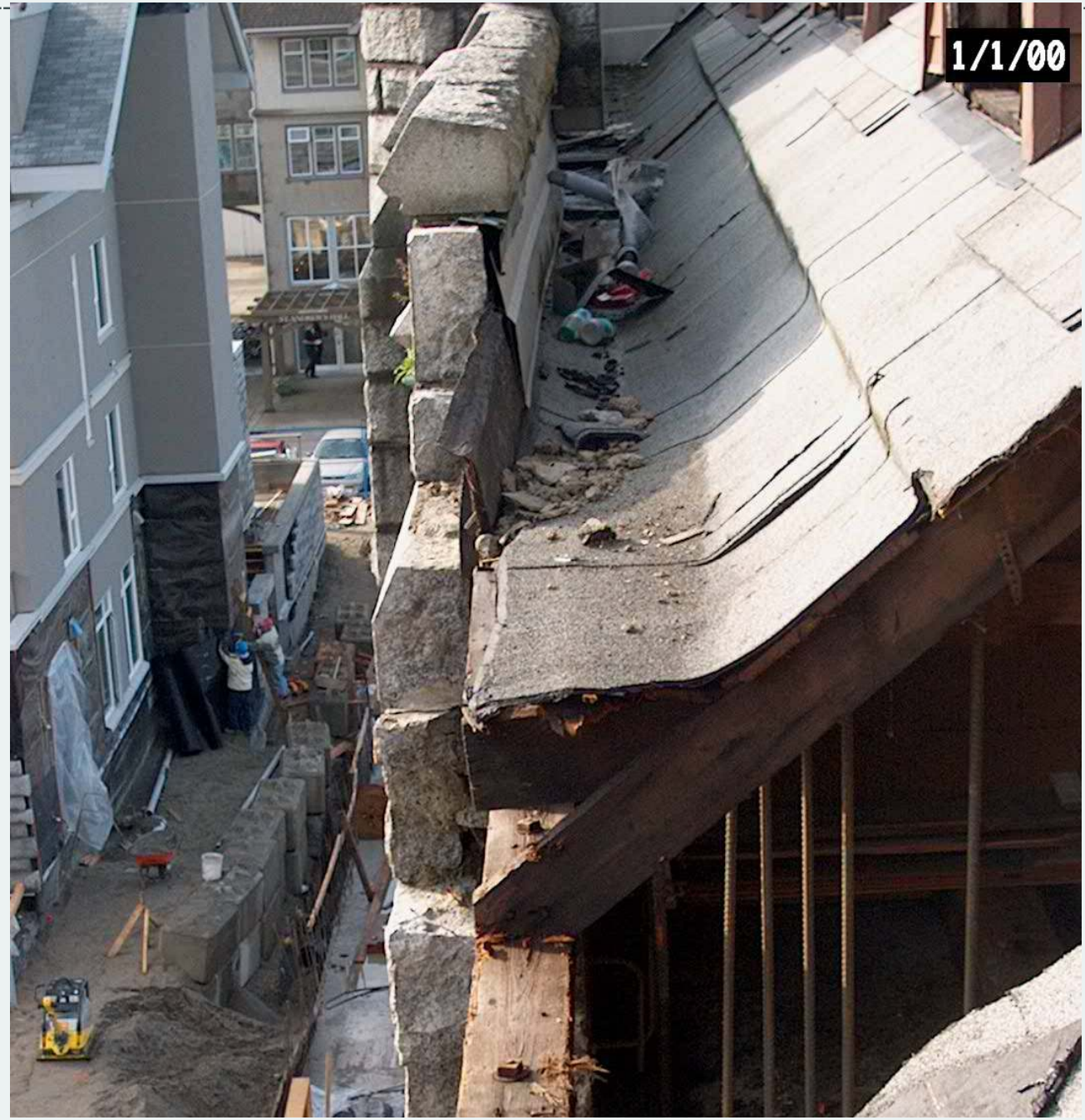

BACK CAULK
(FULL PERIMETER)
SEAL FRAME TO ANGLE
PAINTED MEDITE SILL
ON SHIMS
1 ½" RIGID INSULATION
SKIRT MOULDING
2 ½" STEEL STUD
2"x6" P.T. WOOD
SILL LINER
SHEET METAL TIE
4'–0" OC
½" GYPSUM WALL BOARD
1 ½" AIR SPACE
2" SPRAY APPLIED
URETHANE FOAM
NEW SHOT CRETE
(AS PER STRUCTURAL
REQUIREMENTS)
EXISTING CONCRETE WALL
EXTENT OF JAMB MEMBRANE
POSITION OF MEMBRANE
END DAM
PREFINISHED METAL FLASHING
ABOVE HORSESHOE SHIM
URETHANE MEMBRANE FROM
TOP OF ANGLE TO STONE STIL
3"MIN.
5"
PROVIDE FABRIC
REINFORCING
ACROSS OPENING
EXISTING STONE SILL
EXISTING RAG FELT
AND FOIL FLASHING TO
REMAIN
NOTE: DO NOT CAULK
SILL FLASHING
TO MEMBRANE

80 year old school

80 year old school

80 year old school- The basics: Saddles

Parapet walls are frequently structurally inadequate to resist seismic forces



80 year old school

80 year old school

New Rule

If a masonry building is over 25 years old, check the condition of the shelf angles.

Carbonation of Concrete

- TOW (Time of Wetness) No Hours above 80%Rh
- Ph lowers RH at which corrosion occurs

$$H_2O + CO_2 \rightleftharpoons HCO_3^- + H^+$$

Cast-in-place concrete walls

Cast-in-place concrete walls

Smith Bros. & Wilson Builders- Architect F.A. Barrs Construction 1928

Popular myth : Old masonry buildings cannot be insulated because this will increase freeze-thaw action that will cause spalling

Assessing the Freeze-Thaw Resistance of Clay Brick for Interior Insulation Retrofit Projects

By John Straube, Christopher Schumacher and Peter Mensinga

- *"frost dilatometry can be used to determine the critical degree of saturation at which freeze-thaw damage is likely to occur…."*
- or… walk around the building and check the condition of bricks in the unheated portions of the building.

New Rule

Have a drainage plan for water that will penetrate the building.

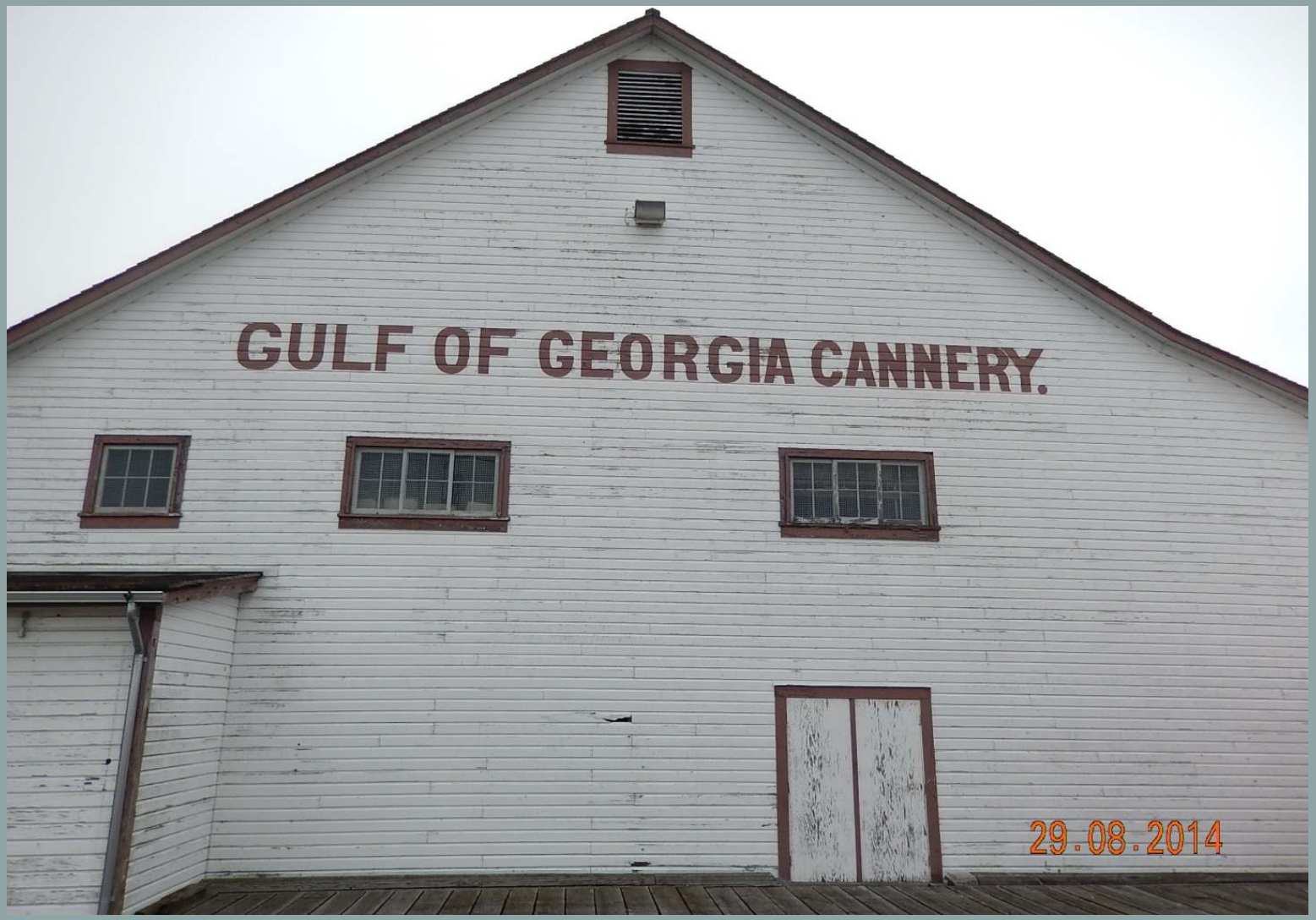
Area under a stairway.

Schools of Thought

- Preservation: Keep building as is as a historical record of the way things were.

- Restoration: Conserve the appearance of the building while adapting the building to modern needs.

Gulf of Georgia Cannery



Gulf of Georgia Cannery

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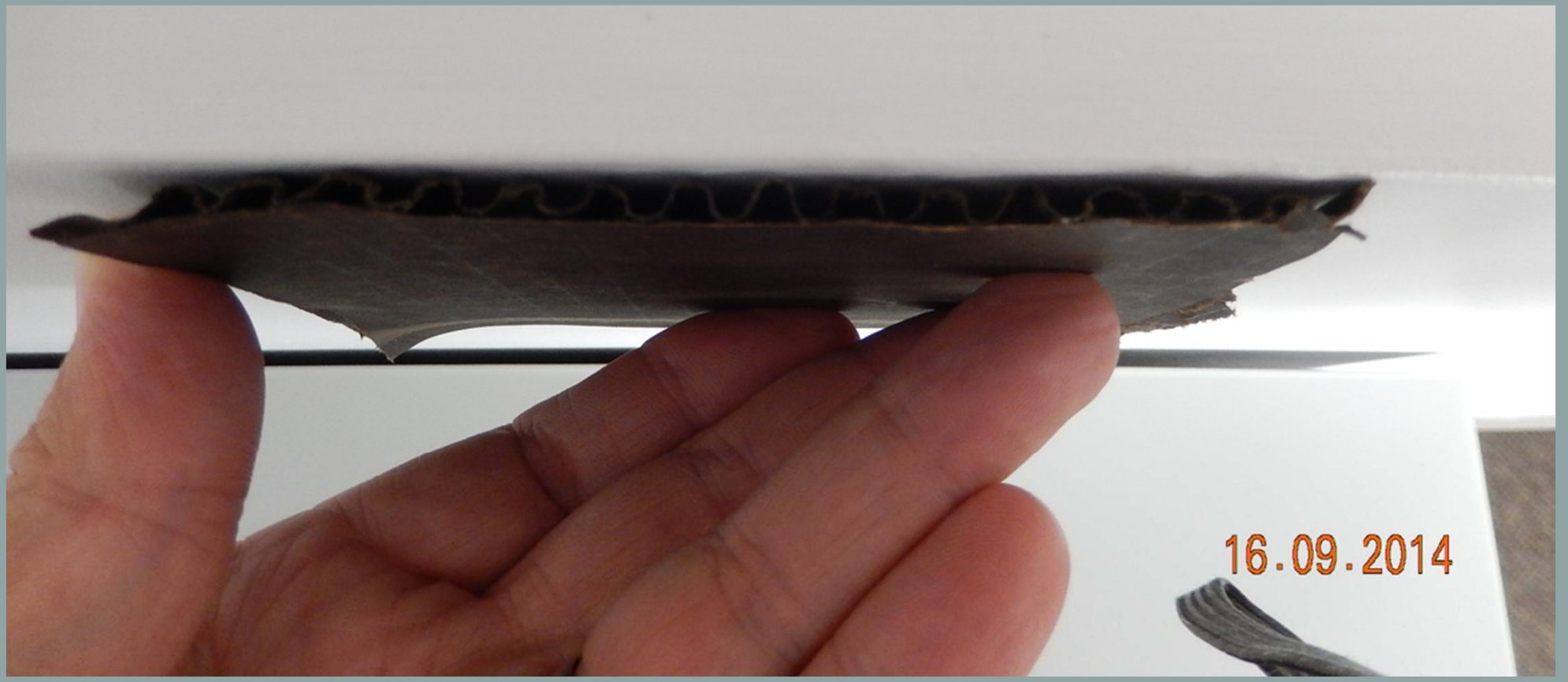
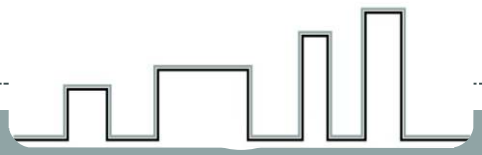


Gulf of Georgia Cannery

Lessons Learned



- Old buildings leaked, sometimes a lot
- Recess windows into walls as far as possible
- Design assemblies that can dry
- Structural concerns will creep up (seismic, corrosion)
- 100 year old masonry walls CAN be insulated (sometimes)
- Sometimes, Preservation will override functionality