

DEEP ENERGY RETROFITS

IEA 61

September 15, 2016

AIR TIGHTNESS OF EXISTING BUILDINGS

By

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Retrofit Air Barriers in Existing Buildings

Deep Energy Retrofits

- Exterior assessment
- Condition of exterior materials
 - Masonry
 - Concrete
 - Precast
 - Wood
- Insulation
 - Interior
 - Exterior
- Air barrier
 - Interior
 - Exterior

Investigate Existing Conditions

- Condition Survey
- Material Properties
- Wetting / Drying Mechanisms
- Exposure History



Deep Energy Retrofits

- Look at parapets, chimneys
- Masonry in attics
- Rebar and lintel corrosion
- Condition of granite, limestone, marble and brownstone
- Airtightness
 - Inside
 - Outside

Condition Survey

- Close up vs. binocular survey.
- Typical vs. survey observations
- Sounding, tactile or other non-destructive assessments.
- Inspection openings.
- Interview building owner/maintenance

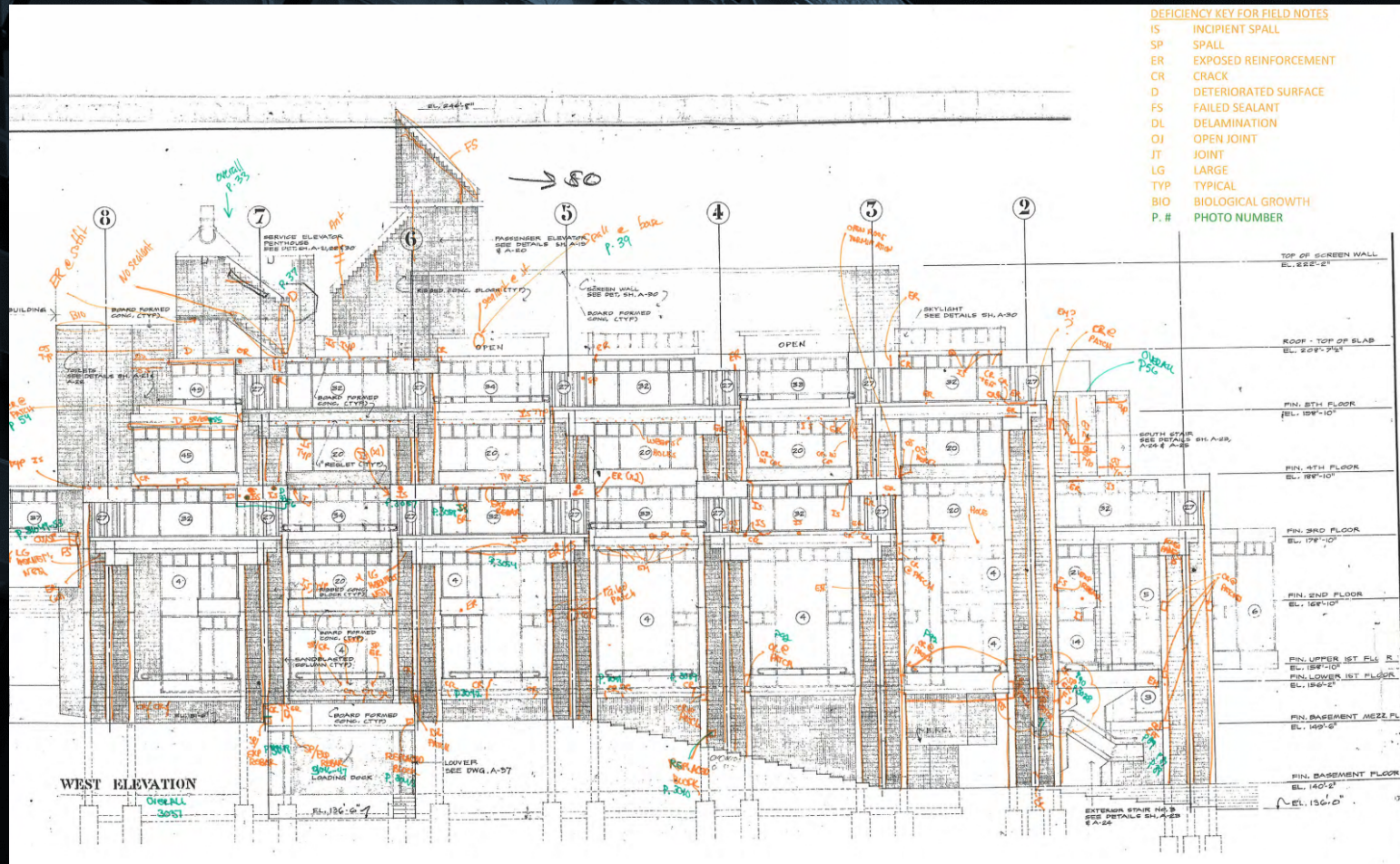


Types of Damage and Deterioration

- Eroded mortar
- Spalling
- Damaged/Missing Flashings
- Sealant Failure
- Efflorescence
- Corrosion of metal elements
- Coating or paint failure
- Differential movement
- Freeze-thaw damage
- Indicators of material performance - parapet walls, chimneys

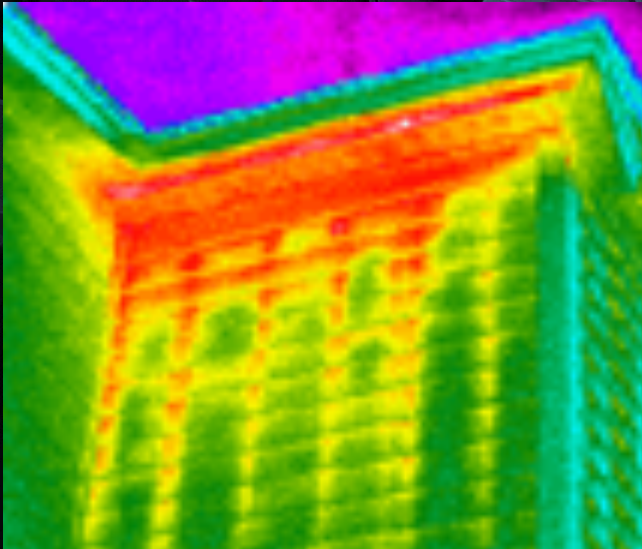


Document Existing Conditions



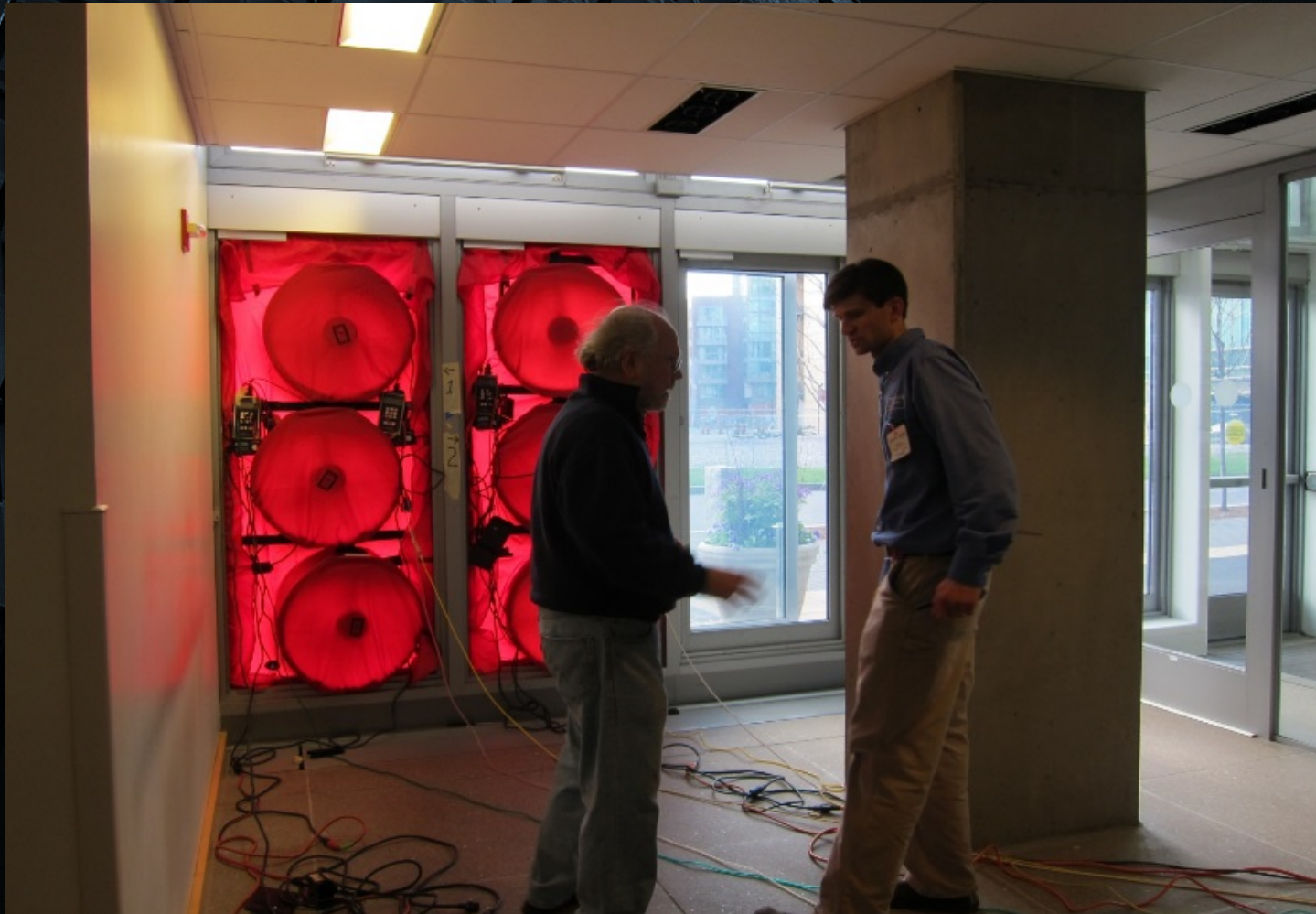
Air Barrier Continuity

- ASTM E1186, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems



- Depressurization testing
- Locating air leakage
 - Infrared thermography
 - Tracer gas testing or theatrical smoke

Depressurization testing



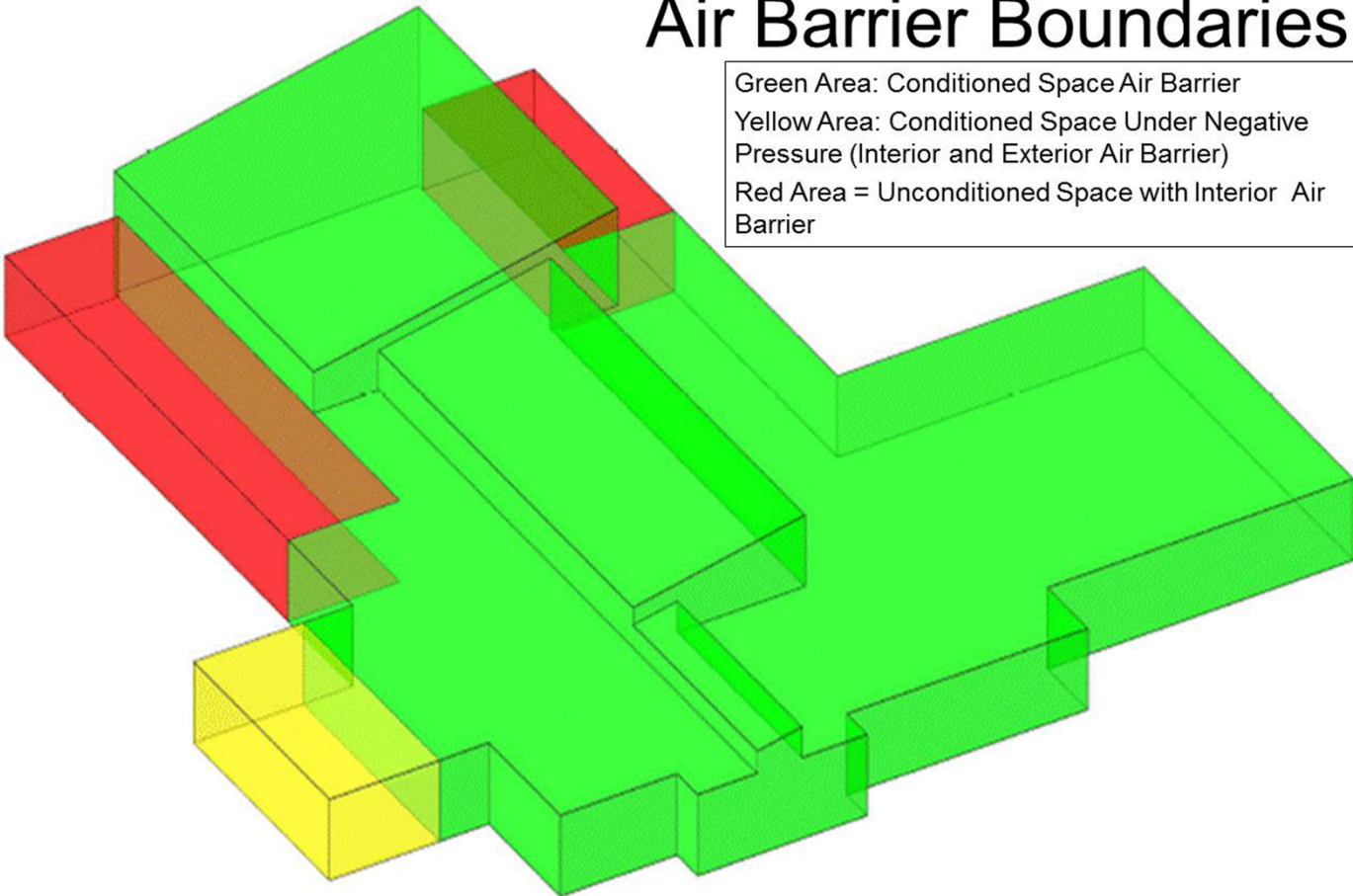
Theatrical fog testing

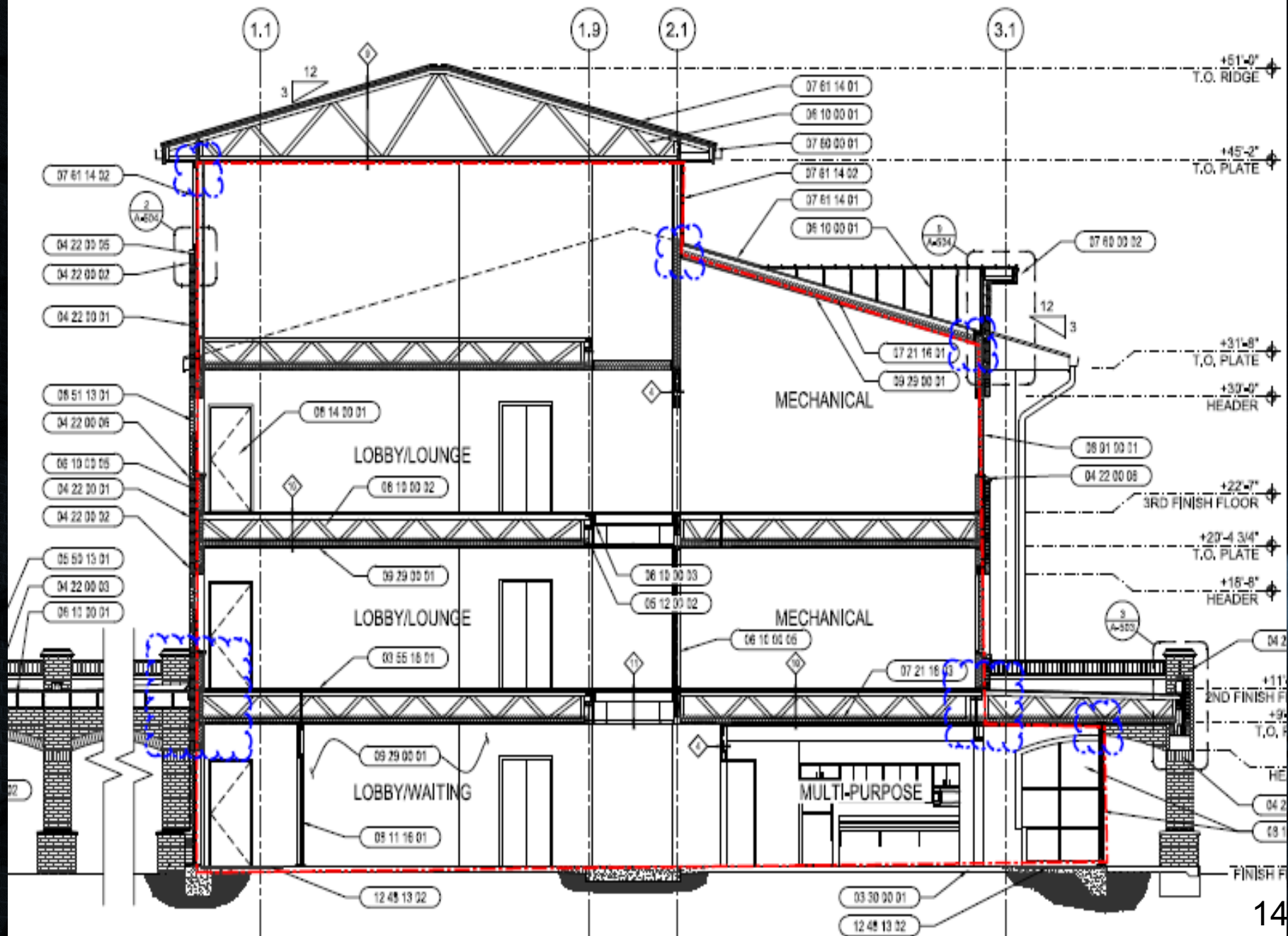


Look at Building Holistically

Air Barrier Boundaries

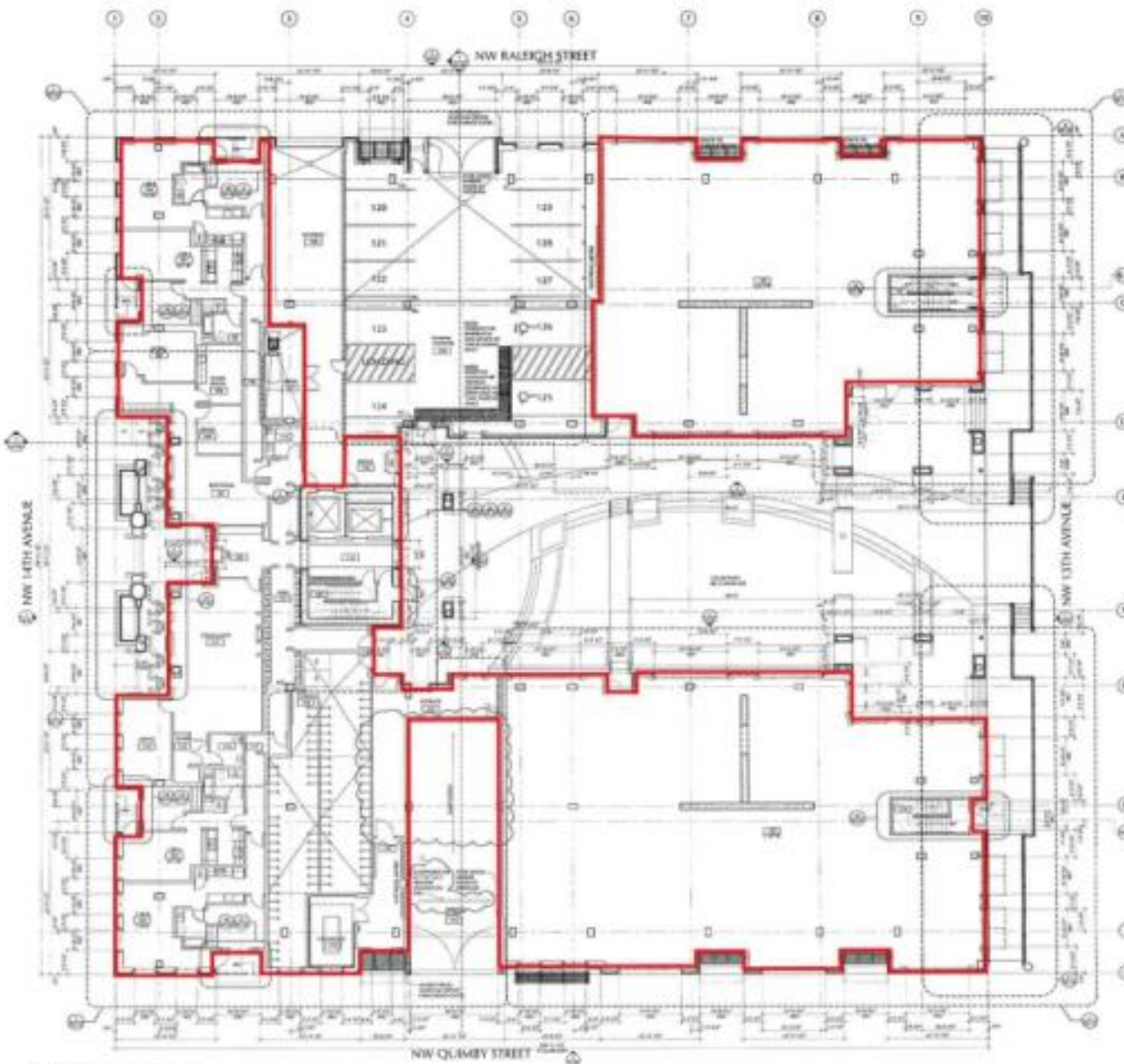
Green Area: Conditioned Space Air Barrier
Yellow Area: Conditioned Space Under Negative Pressure (Interior and Exterior Air Barrier)
Red Area = Unconditioned Space with Interior Air Barrier







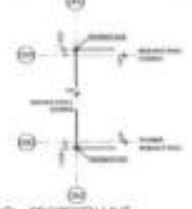
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ARCHITECTS, INC.
1000 NE 10TH AVENUE, SUITE 200
PORTLAND, OREGON 97232
TEL: 503.255.1100
WWW.ANKRUMMOSAN.COM



- GENERIC HOTEL**
- 1. GENERAL NOTES: SEE ARCHITECTURAL SPECIFICATIONS AND SUPPLEMENTAL SPECIFICATIONS FOR GENERAL NOTES AND MATERIALS.
 - 2. AIR BARRIER: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 3. PENETRATIONS: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 4. JOINTS: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 5. WALLS: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 6. FLOORS: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 7. CEILING: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 8. ROOF: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 9. MECHANICAL: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 10. ELECTRICAL: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 11. PLUMBING: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 12. FIRE PROTECTION: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 13. FINISHES: SEE SECTION 05050 FOR DETAILS AND MATERIALS.
 - 14. OTHER: SEE SECTION 05050 FOR DETAILS AND MATERIALS.

- WALL KEY**
- 1. EXTERIOR WALL
 - 2. INTERIOR WALL
 - 3. PARTITION WALL
 - 4. CURTAIN WALL
 - 5. GLAZED PARTITION
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- LEGEND**
- 1. AIR BARRIER
 - 2. PENETRATION
 - 3. JOINT
 - 4. WALL
 - 5. FLOOR
 - 6. CEILING
 - 7. ROOF
 - 8. MECHANICAL
 - 9. ELECTRICAL
 - 10. PLUMBING
 - 11. FIRE PROTECTION
 - 12. FINISHES
 - 13. OTHER



PROPERTY LINE

PEARL FAMILY HOUSING
N.W. 15TH AND N.W. QUIMBY
PORTLAND, OREGON
A UJIC/UMI PARTNERSHIP

NO.	DATE	DESCRIPTION
1	10/15/11	ISSUED FOR PERMIT
2	11/15/11	ISSUED FOR CONSTRUCTION
3	12/15/11	ISSUED FOR CONSTRUCTION
4	01/15/12	ISSUED FOR CONSTRUCTION
5	02/15/12	ISSUED FOR CONSTRUCTION
6	03/15/12	ISSUED FOR CONSTRUCTION
7	04/15/12	ISSUED FOR CONSTRUCTION
8	05/15/12	ISSUED FOR CONSTRUCTION
9	06/15/12	ISSUED FOR CONSTRUCTION
10	07/15/12	ISSUED FOR CONSTRUCTION
11	08/15/12	ISSUED FOR CONSTRUCTION
12	09/15/12	ISSUED FOR CONSTRUCTION
13	10/15/12	ISSUED FOR CONSTRUCTION
14	11/15/12	ISSUED FOR CONSTRUCTION
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27	12/15/13	ISSUED FOR CONSTRUCTION
28	01/15/14	ISSUED FOR CONSTRUCTION
29	02/15/14	ISSUED FOR CONSTRUCTION
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98	11/15/19	ISSUED FOR CONSTRUCTION
99	12/15/19	ISSUED FOR CONSTRUCTION
100	01/15/20	ISSUED FOR CONSTRUCTION

A2.01

CONSTRUCTION SET

Air Barrier Continuity



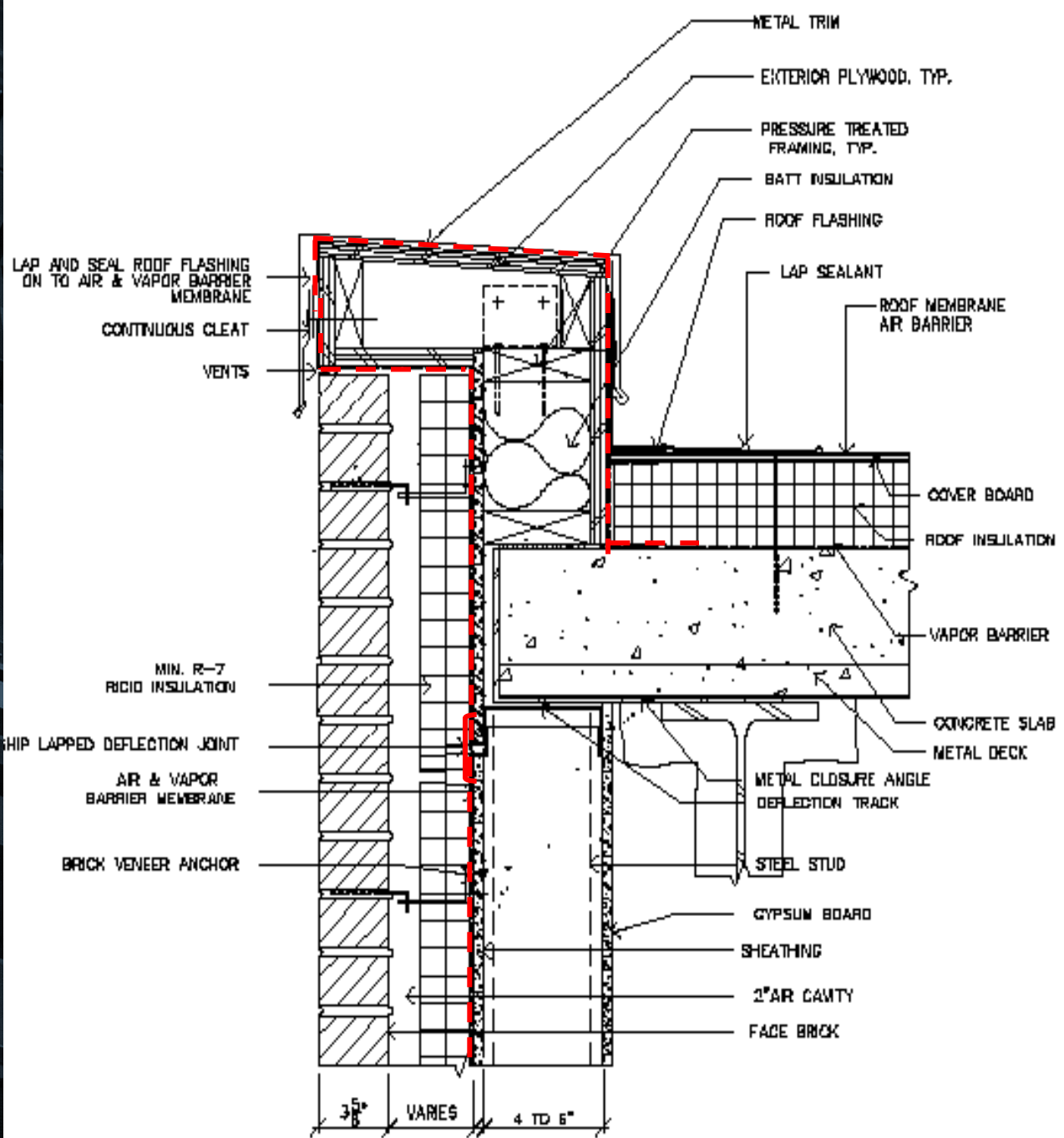
Interior or exterior air barrier?

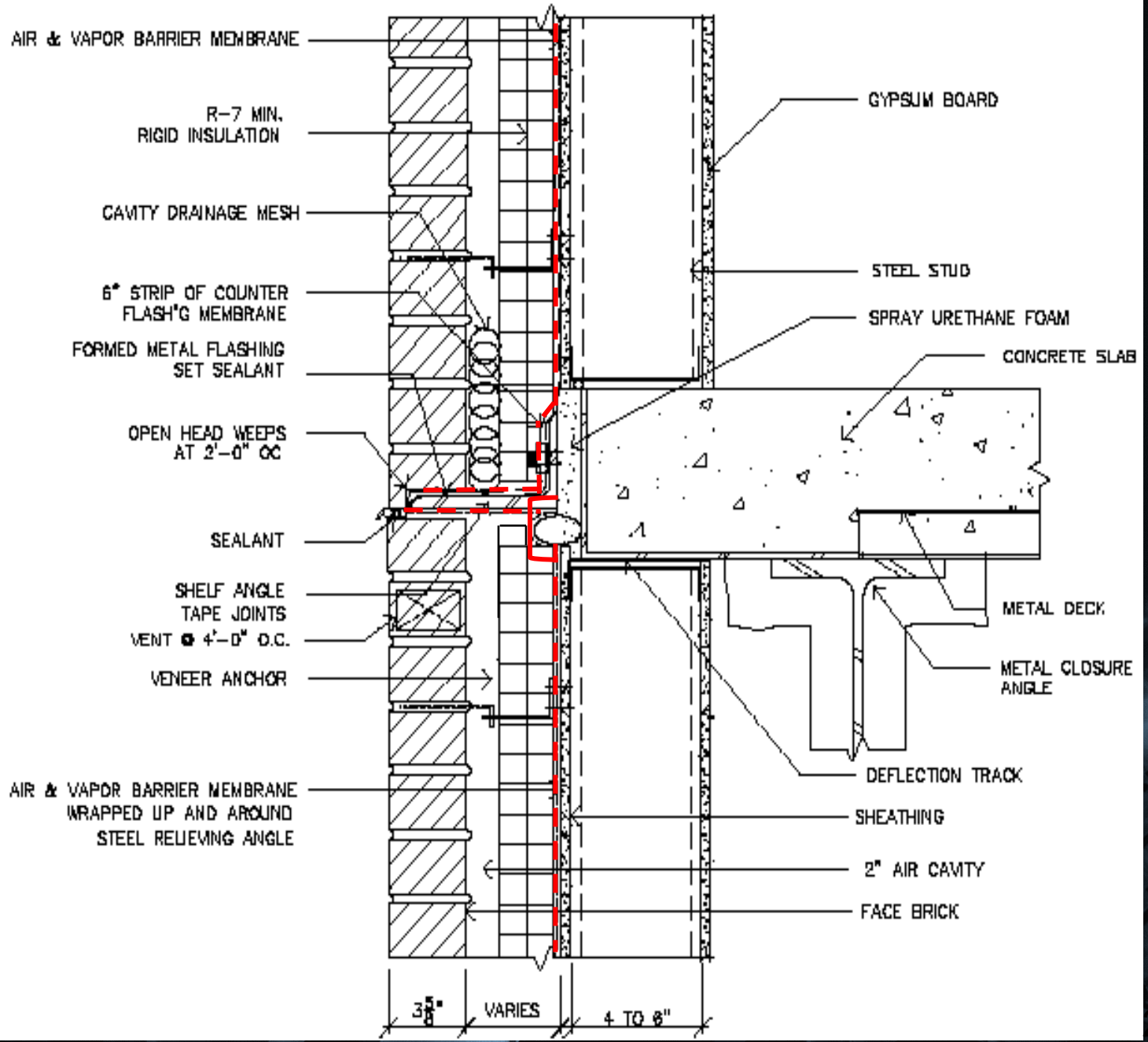


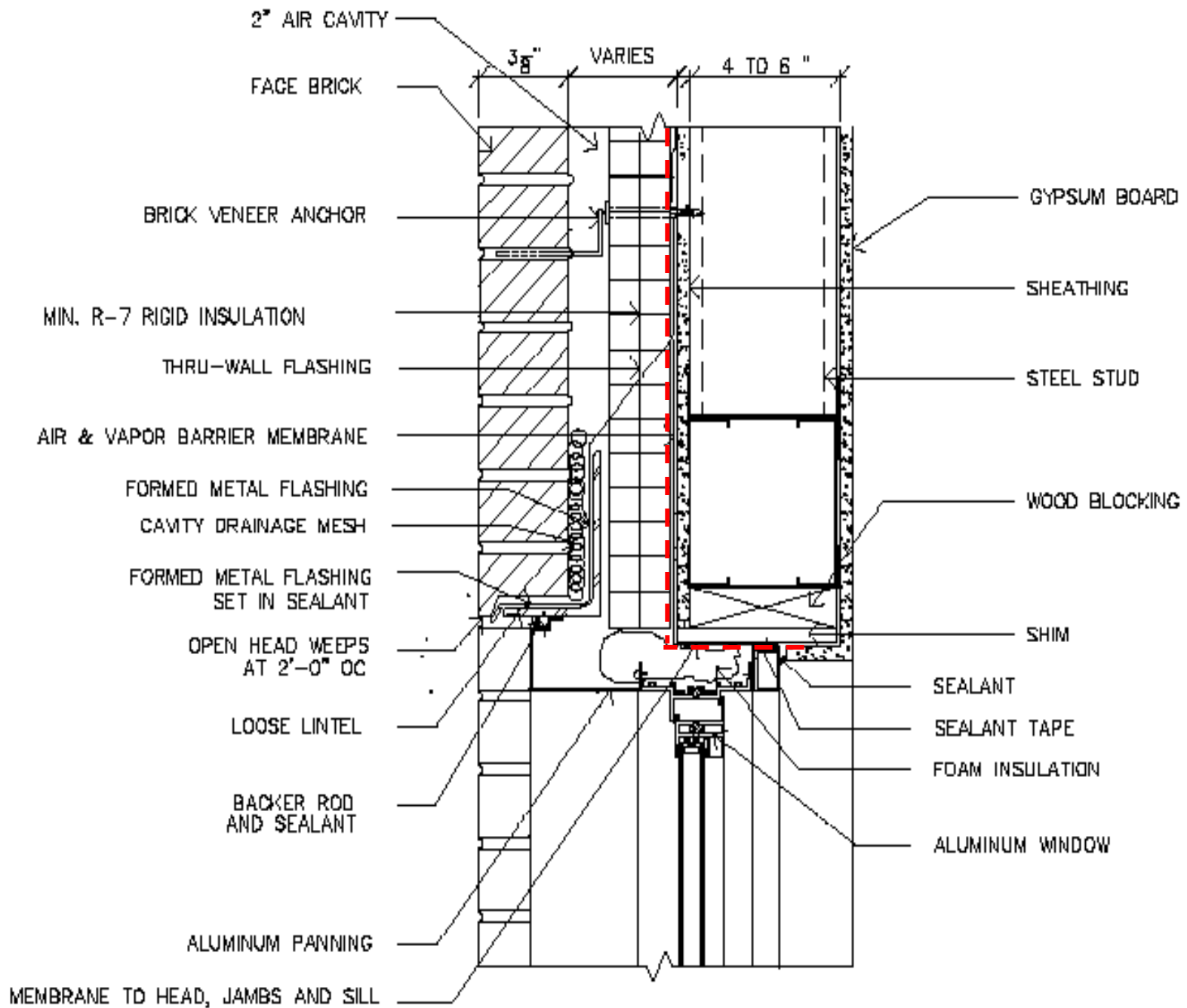
Exterior air barrier and recladding

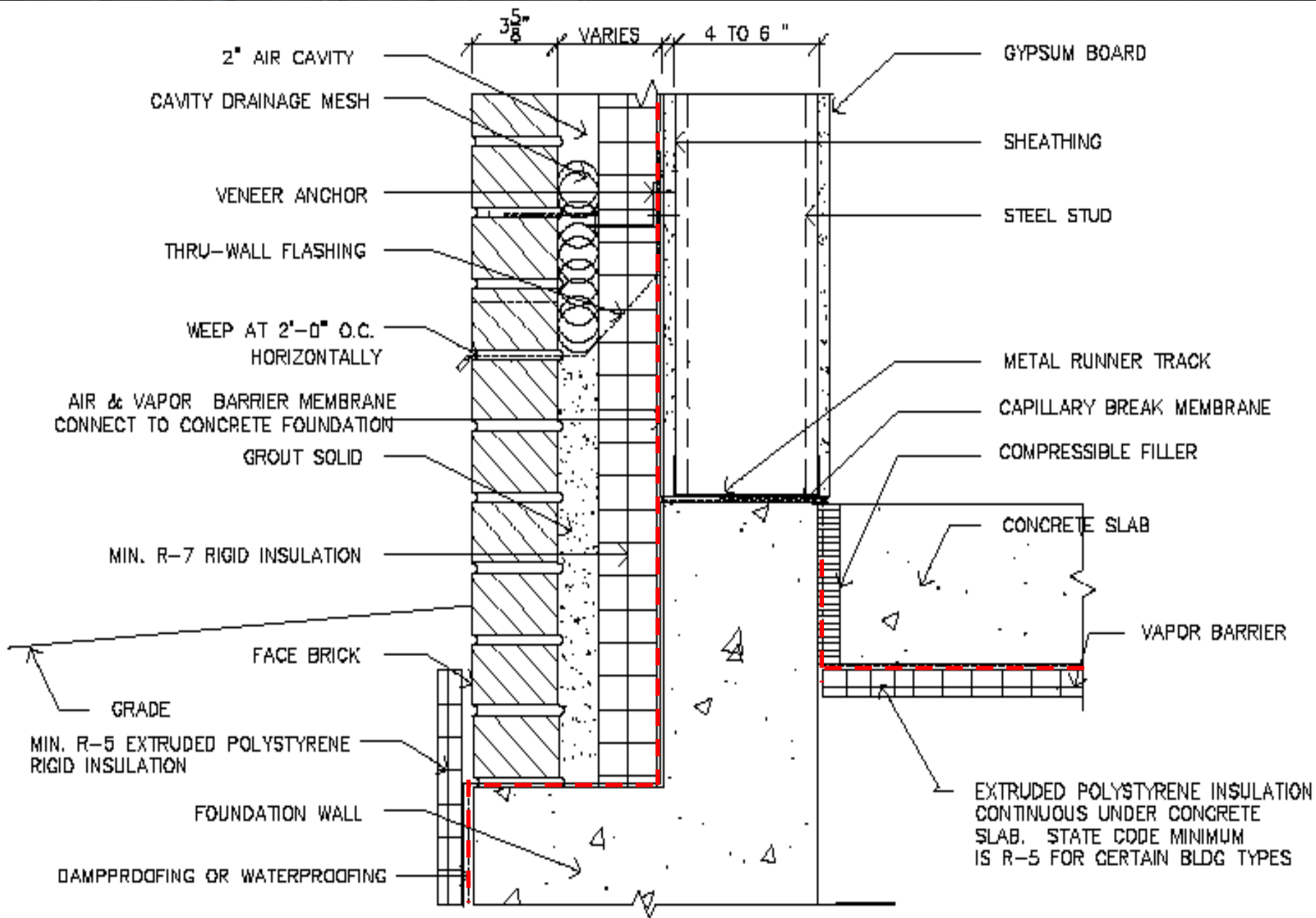
Air barrier applied to existing wall











LBJ Apartments, Cambridge, Massachusetts

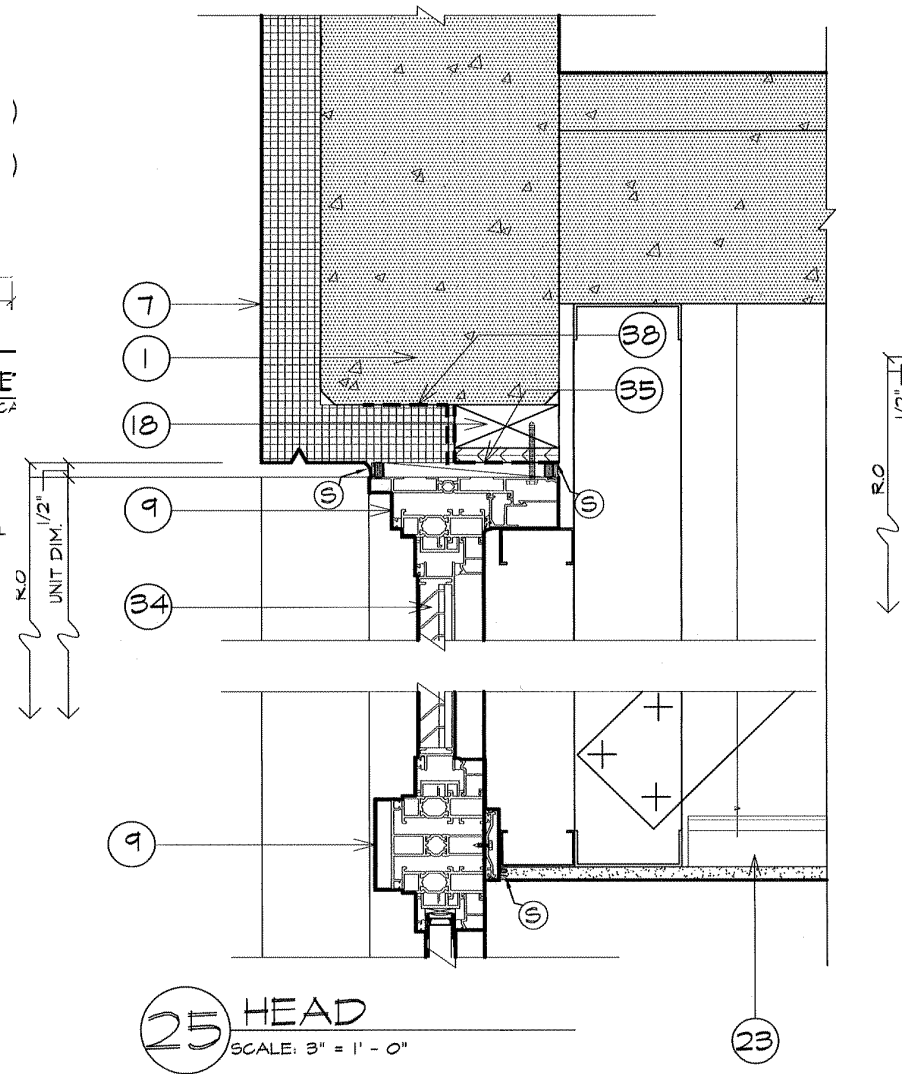
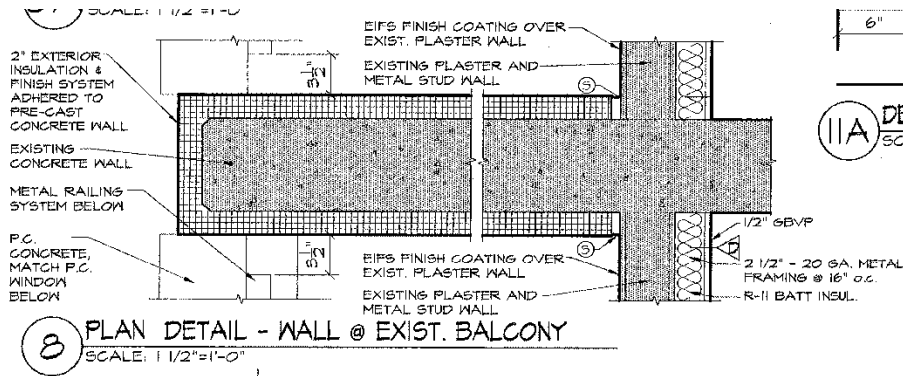
- Existing Construction.
- Cambridge Housing Authority.
- 178 Units.
- Elderly/Disabled.
- Post tensioned concrete structure with precast spandrels and floors.
- Chronically Underfunded.



LBJ Apartments: EIFS



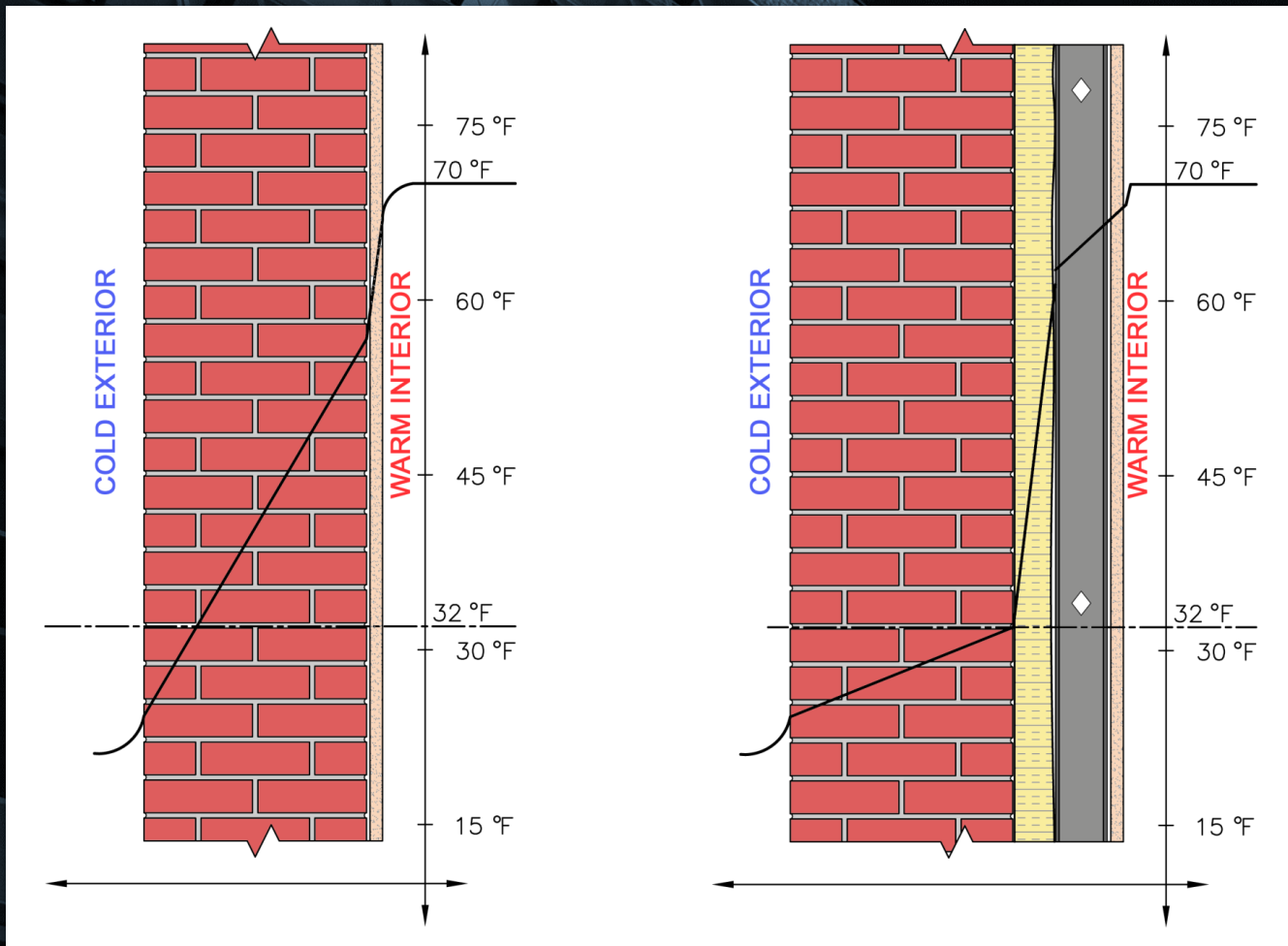
LBJ Apartments: EIFS



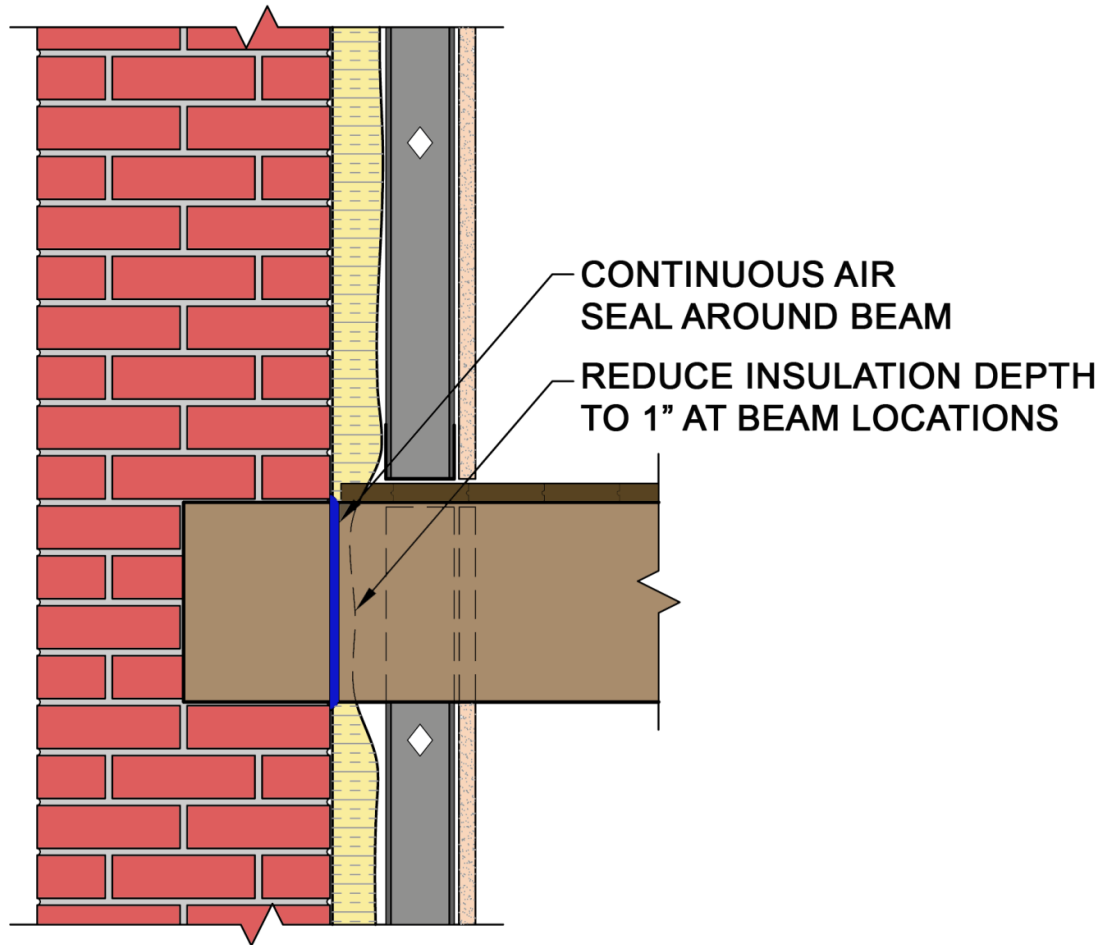


Gut Renovation
Façade restoration
Interior air barrier

How much is too much?

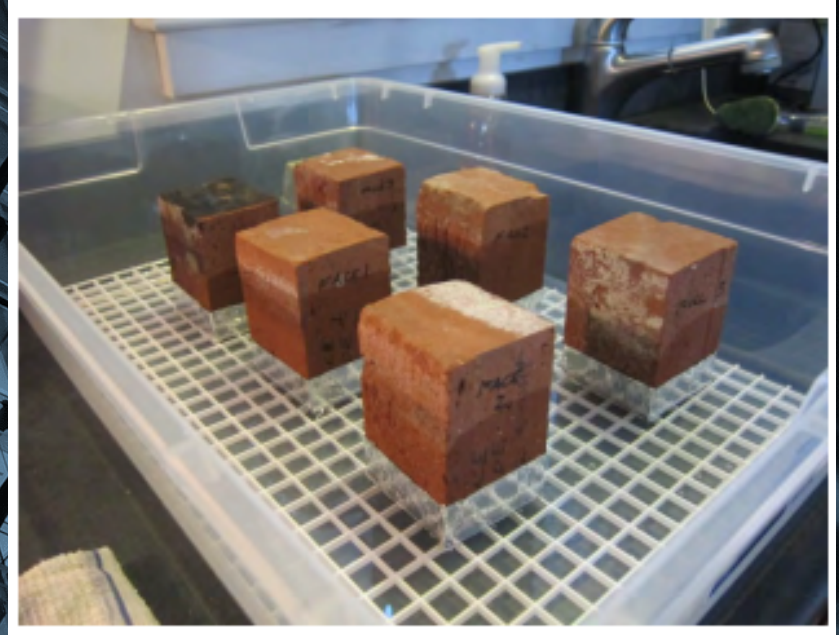


Embedded Structure



Material Properties

- Material physical properties
 - Dry density
 - Liquid water uptake (A-value)
 - Saturation moisture content
 - Frost dilatometry, S_{crit}
- Hazardous materials

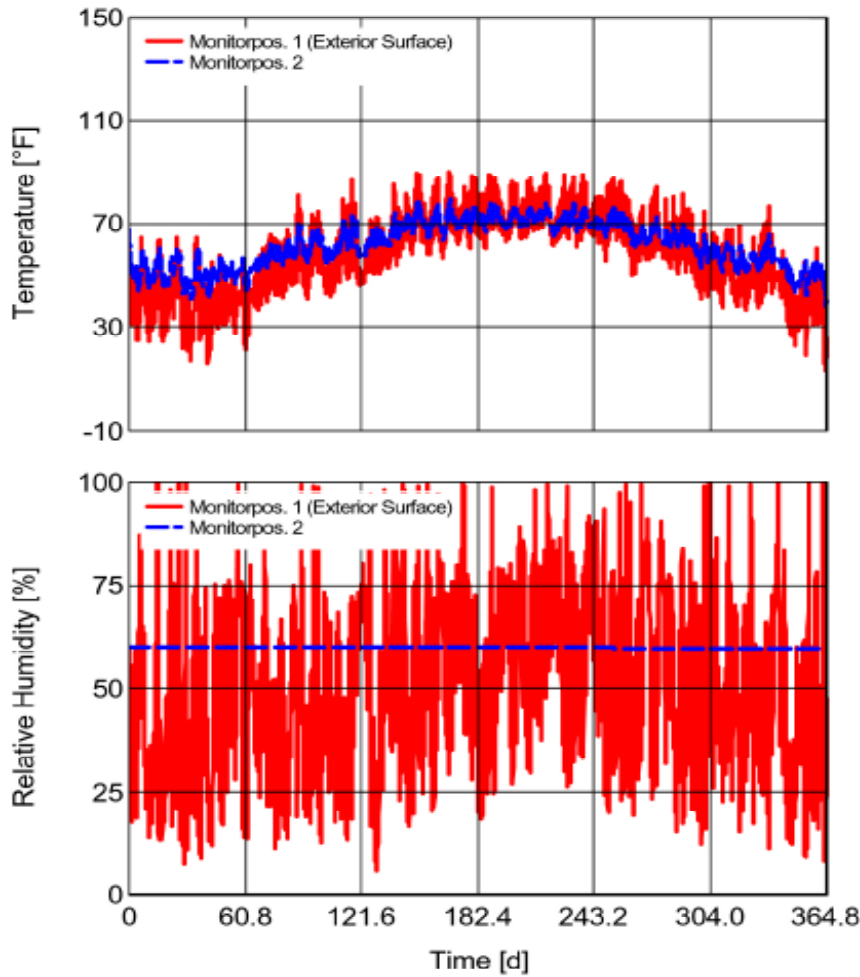


Field Testing and In-situ Monitoring

- Local climate and rain water conditions.
- Absorption (Rilem tube, ASTM C1601)
- Water penetration
- Air leakage



Vapor Control



WUFI Pro
Delphin

8760 Hour Calculations

Transient Hygrothermal Analysis

Gallatin Hall – HBS – McKim, Mead & White





Gut renovations



Gallatin Hall HBS – LEED Gold



Flashing transitions at windows



Window flashing transitions



Insulate and air seal wall and roof



Gut renovations - Deerfield Arts



Window flashings



Air barrier seal at Window to flashing



Roofs – A huge opportunity







Sealing existing buildings (most difficult)



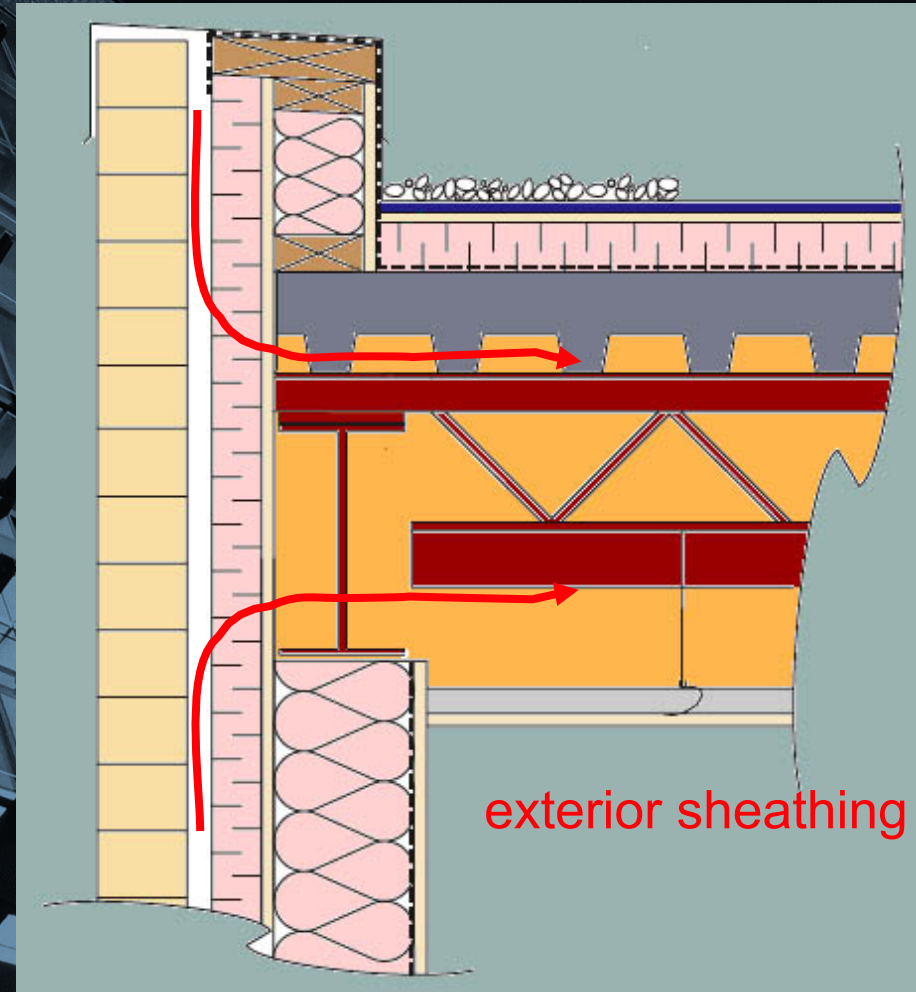
I. Seal Top of Building

Seal top of building

- Reroofing AVB
- Attics
- Roof/wall intersections and plenum spaces
- Mechanical penthouse doors and walls
- HVAC equipment penetrations through the roof
- Other roof penetrations, such as plumbing vent stacks

Air Barrier Continuity

- The plenum
 - Air can infiltrate through many different assemblies if air barrier systems are not in place



Air Barrier Continuity

Seal top of building



Air Barrier Continuity

Seal top of building



Weatherstrip existing doors





II. Bottom of Building

Bottom of Building

- Exterior soffits, canopies and ground floor access doors
- Underground parking access doors and elevators
- Exhaust and air intake louvers and vents
- Pipe, duct, cable and other service penetrations into core and shafts of building
- Sprinkler head penetrations, inspection access doors and hatches.
- Seal core wall to floor slab
- Residential crawl spaces and penetrations, vented or unvented.
- Loading docks



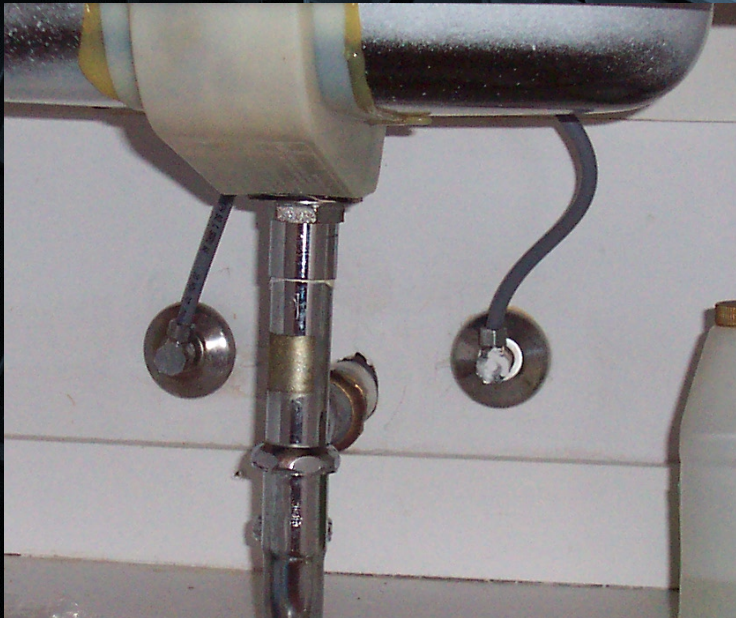
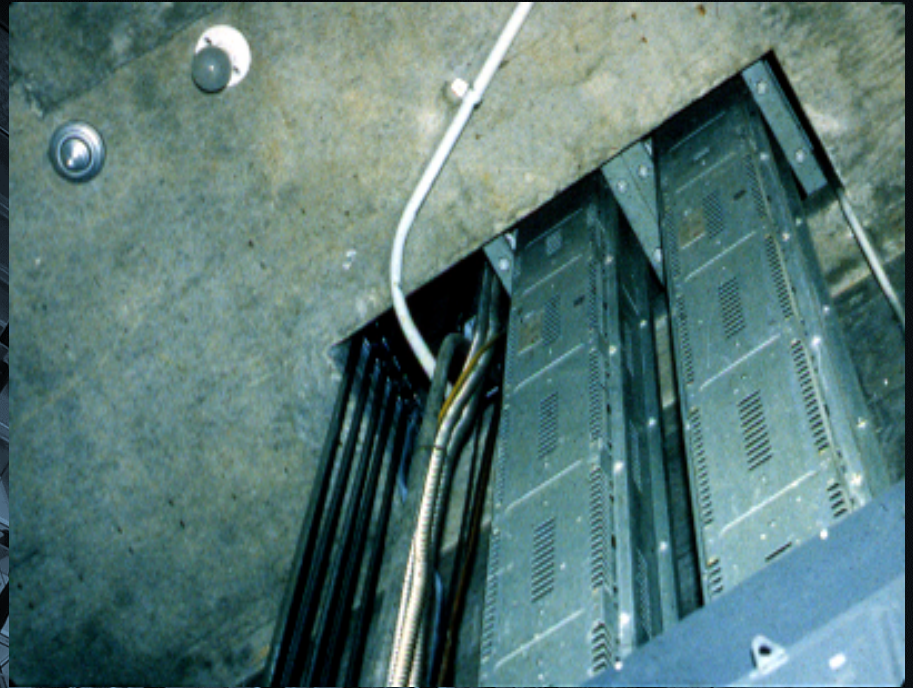
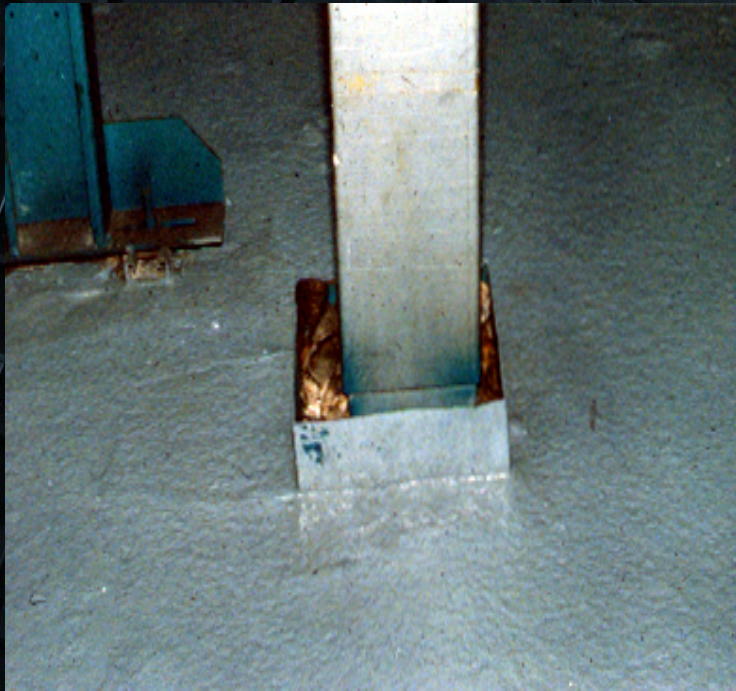



III. Seal the Vertical Shafts

Seal the shafts

- Stairwell fire doors
- Fire hose cabinets
- Plumbing, electrical, cable and other penetrations within service rooms
- Elevator rooms- cable holes, door controller cable holes, bus bar openings
- Garbage chute perimeter and access hatches
- Hallway pressurization grille perimeters
- Smoke shaft access doors
- Elevator shaft smoke control grilles
- Mechanical & electrical shafts







IV. Seal the exterior walls

Seal exterior walls

- Seal individual leakage pathways
- Windows
- Sealants
- Radiation piping penetrations
- Floor and ceiling intersections with exterior wall
- Plenums

Contact Information

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