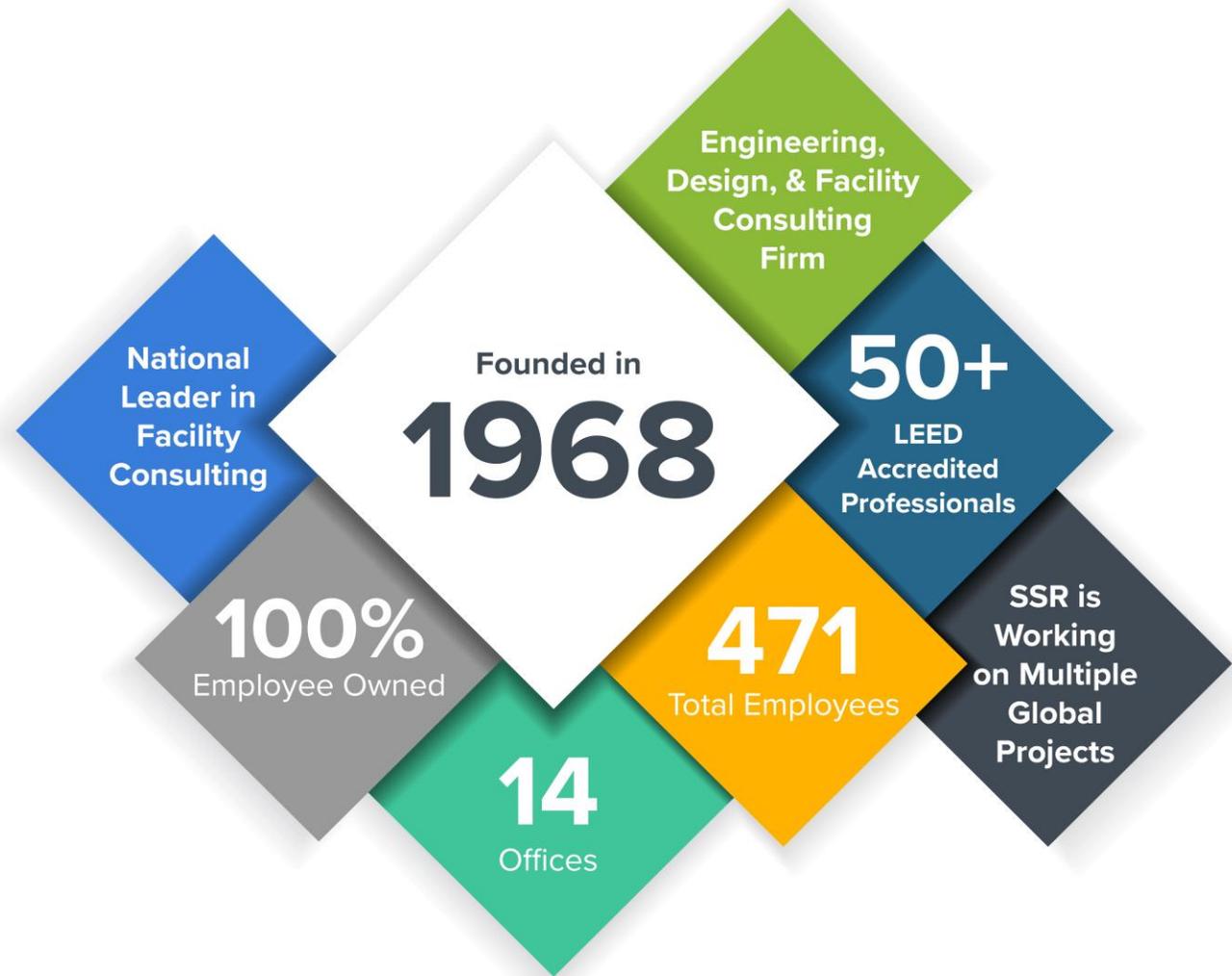




OVERVIEW OF BUILDING ENCLOSURE SYSTEMS AND CONSULTING SERVICES

February 21, 2023



National
Leader in
Facility
Consulting

Founded in
1968

Engineering,
Design, & Facility
Consulting
Firm

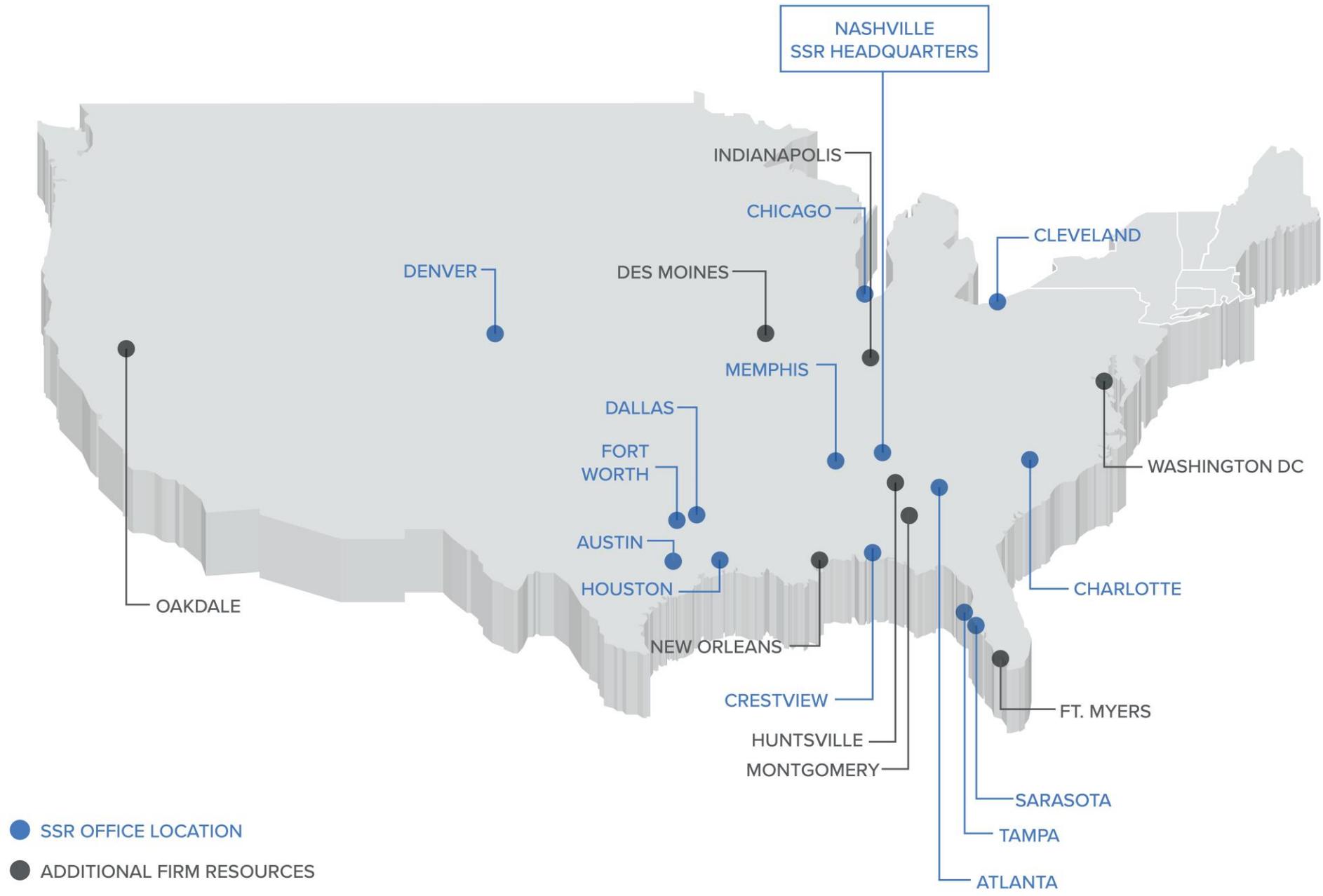
50+
LEED
Accredited
Professionals

100%
Employee Owned

471
Total Employees

SSR is
Working
on Multiple
Global
Projects

14
Offices



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LEARNING OBJECTIVES

1. Identify and review building enclosure systems
2. Discuss risk associated with modern construction
3. Review risk mitigation in new construction
4. Review risk mitigation for existing buildings

BUILDING ENCLOSURE SYSTEMS

BUILDING ENCLOSURE SYSTEMS

- Roofing
- Exterior walls
- Waterproofing
- Vapor / air barriers
- Insulation
- Curtain wall systems
- Storefront
- Cladding



ROOFING SYSTEMS

- Single Ply (TPO, EPDM, PVC)
- Modified & Built Up
- Metal Panels
- Green Roof Systems
- Coatings
- Steep Slope (Metal, Shingles, Slate)
- Spray Polyurethane Foam



WALL SYSTEMS

- Moisture barriers
- Air barriers
- Vapor barriers
- Cladding (masonry, metal panel, Terra Cotta etc.)
- Insulated metal panels
- Precast concrete
- Insulation
- Spray polyurethane foam
- Below grade waterproofing



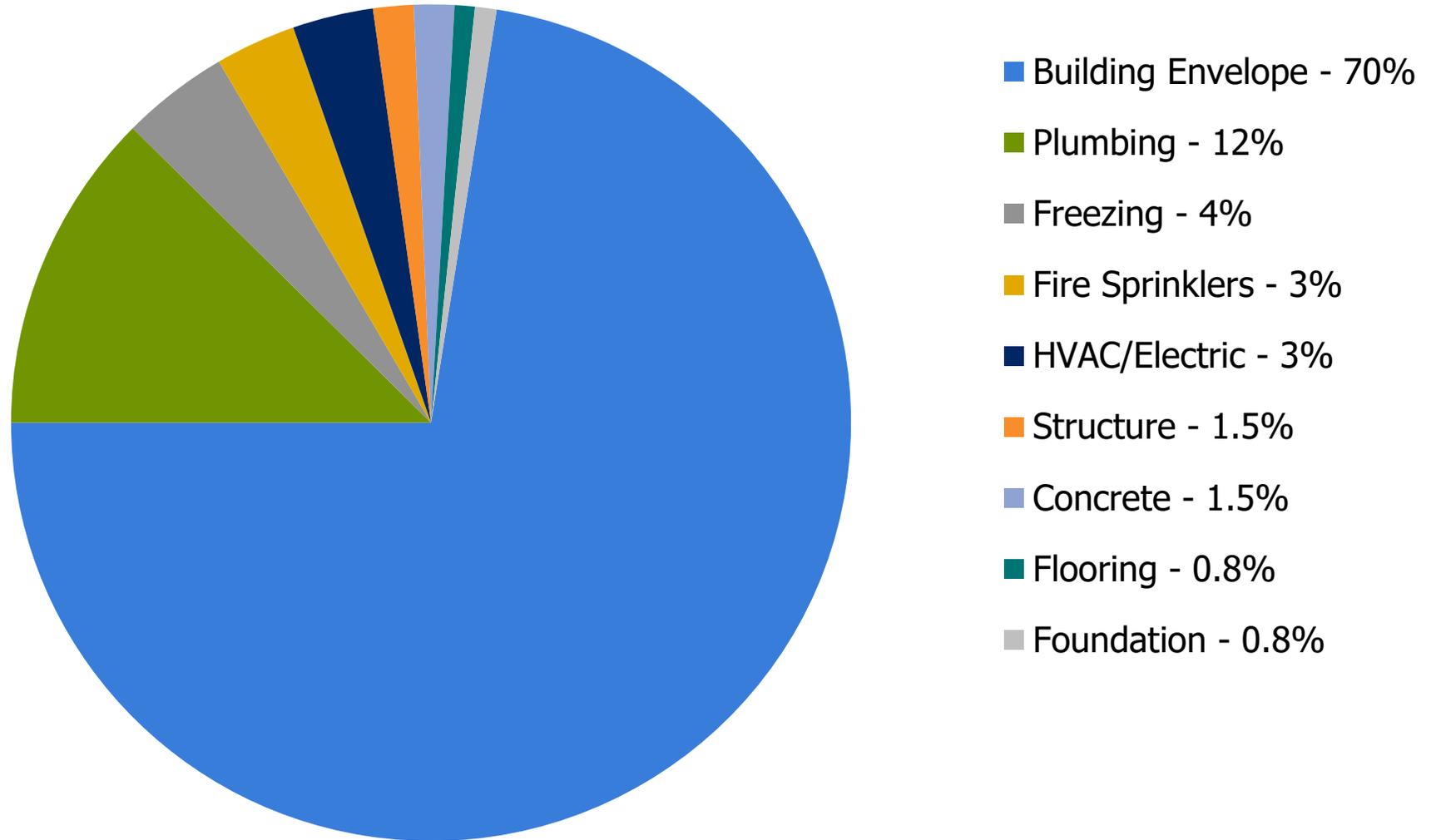
FENESTRATIONS

- Windows
- Window wall
- Storefront
- Curtain wall
- Doors
- Louvers



BUILDING ENCLOSURE RISK

CONSTRUCTION INDUSTRY DEFECT CLAIMS*



ENVELOPE INDUSTRY TRENDS

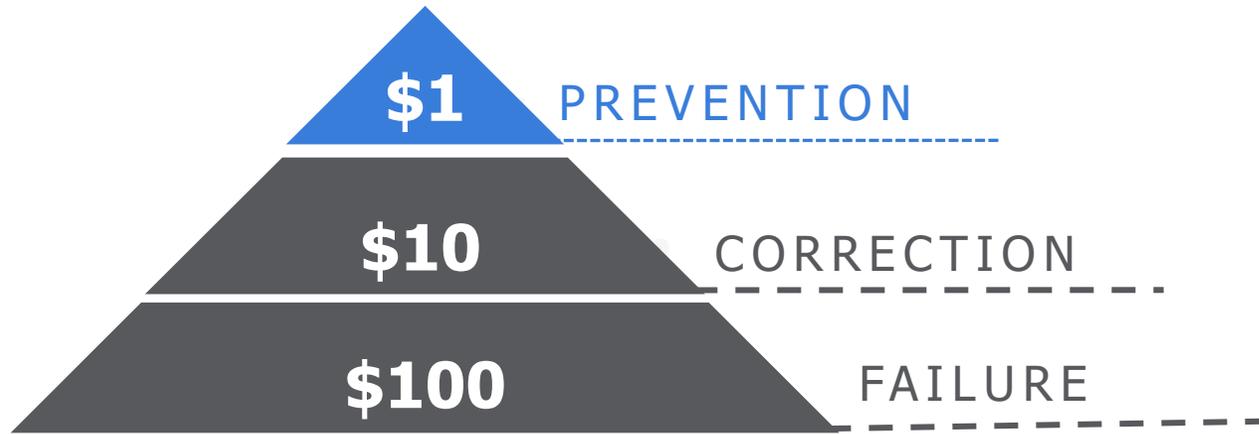


ENVELOPE INDUSTRY TRENDS

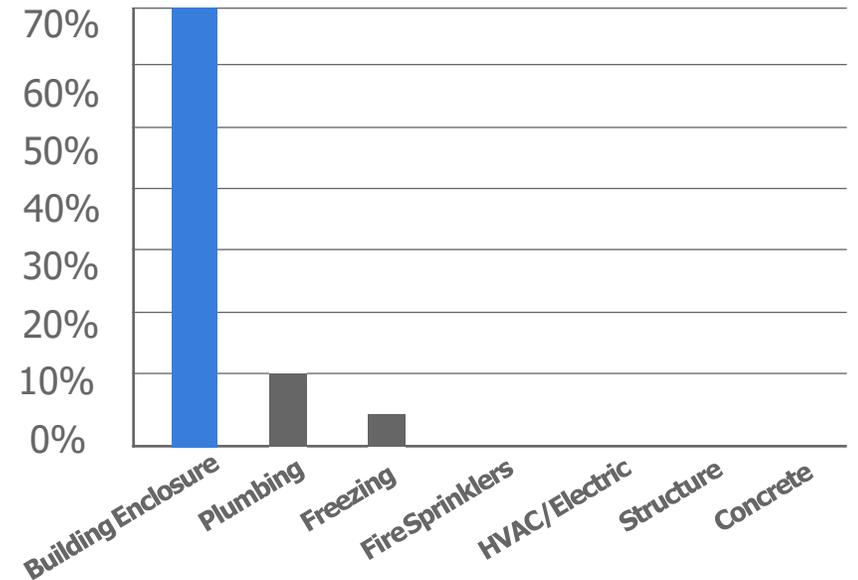


BUILDING ENCLOSURE 1-10-100 RULE

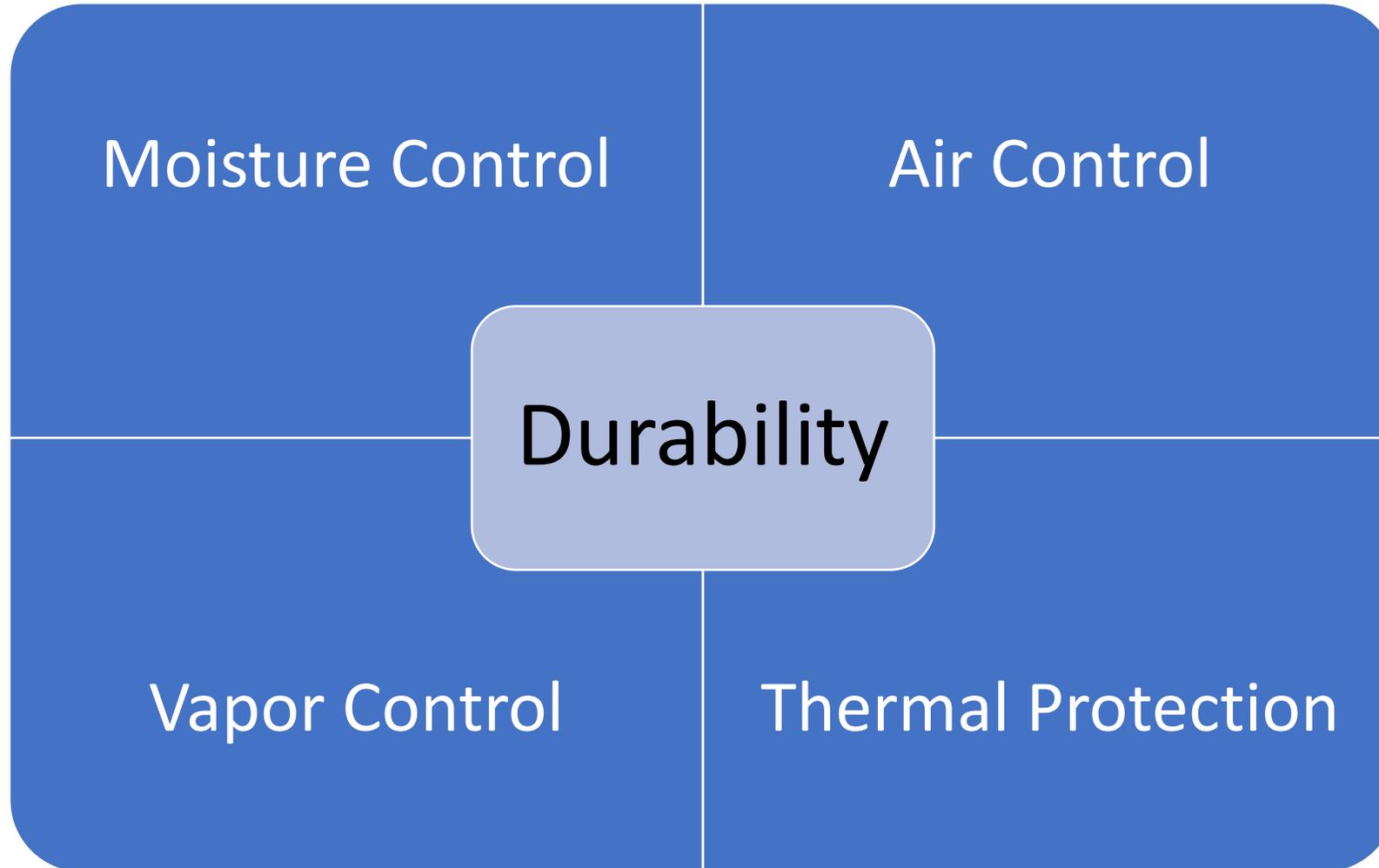
1-10-100 RULE³



CONSTRUCTION
INDUSTRY DEFECTS
CLAIM SURVEY



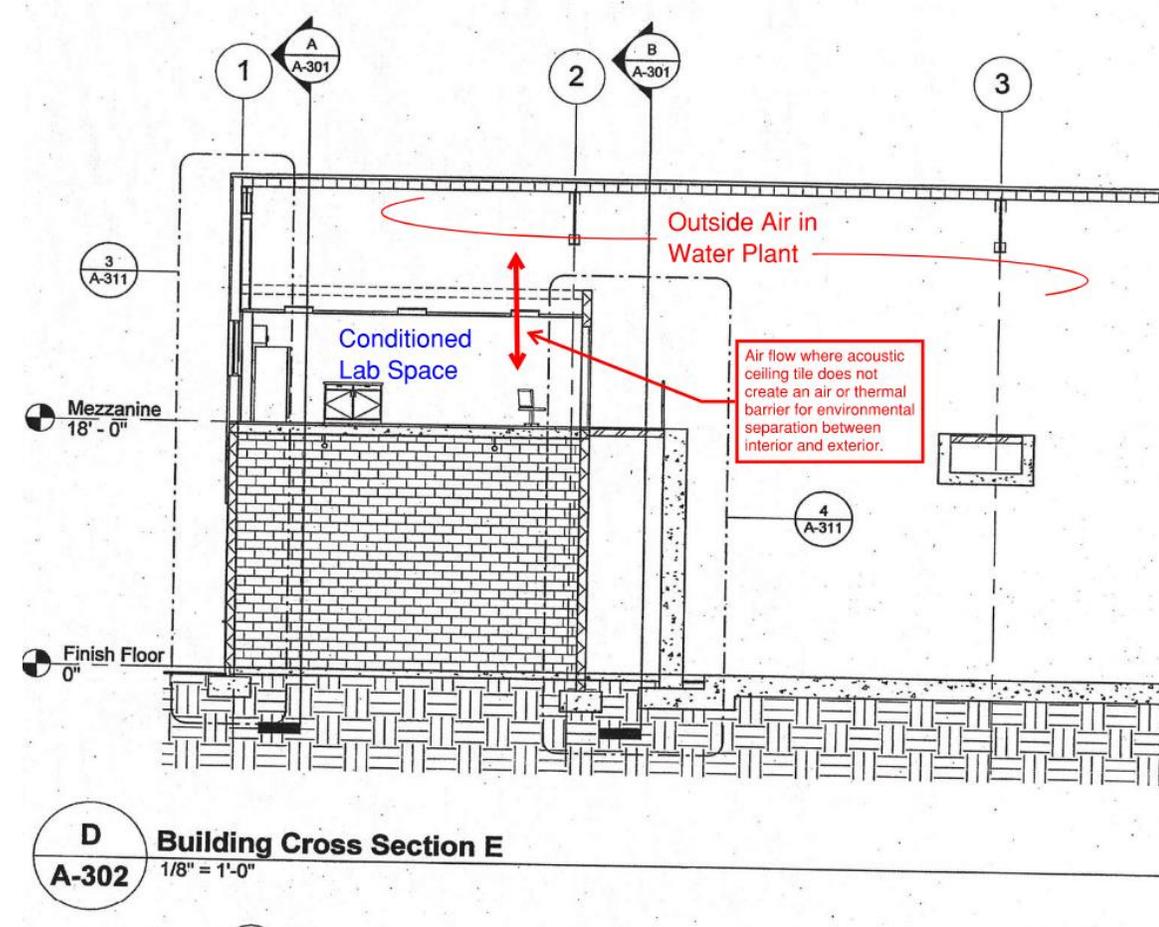
ENCLOSURE PERFORMANCE



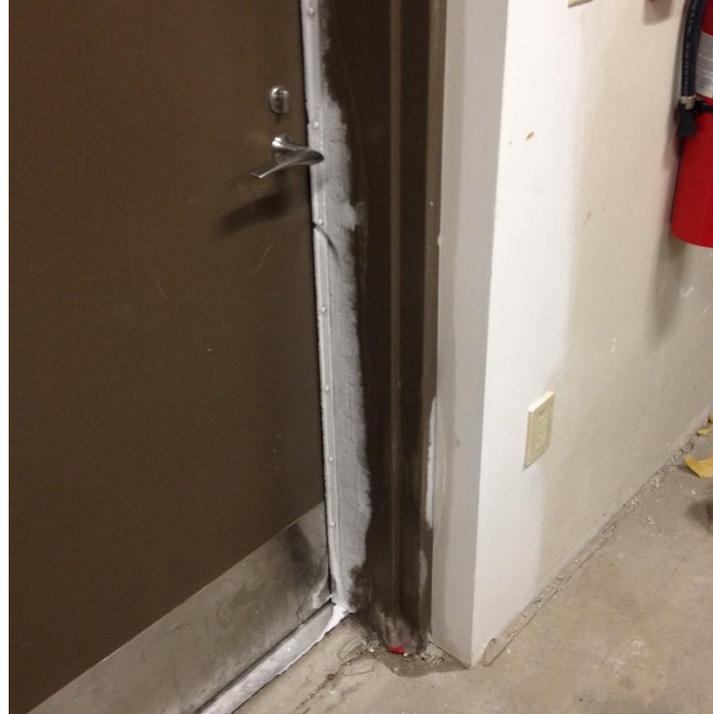
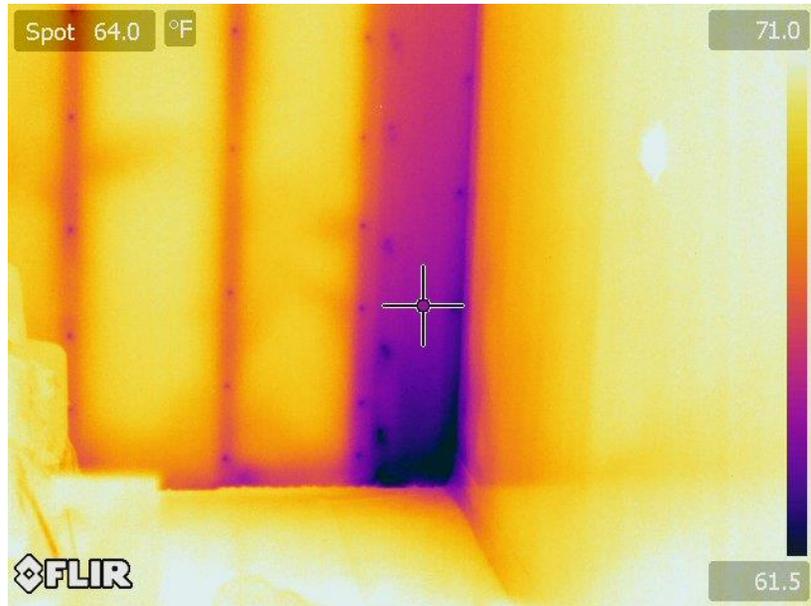
ENCLOSURE PERFORMANCE – Air & Moisture



ENCLOSURE PERFORMANCE – Air Control



ENCLOSURE PERFORMANCE – Thermal Performance



RISK MITIGATION: NEW CONSTRUCTION

BUILDING ENCLOSURE CONSULTING

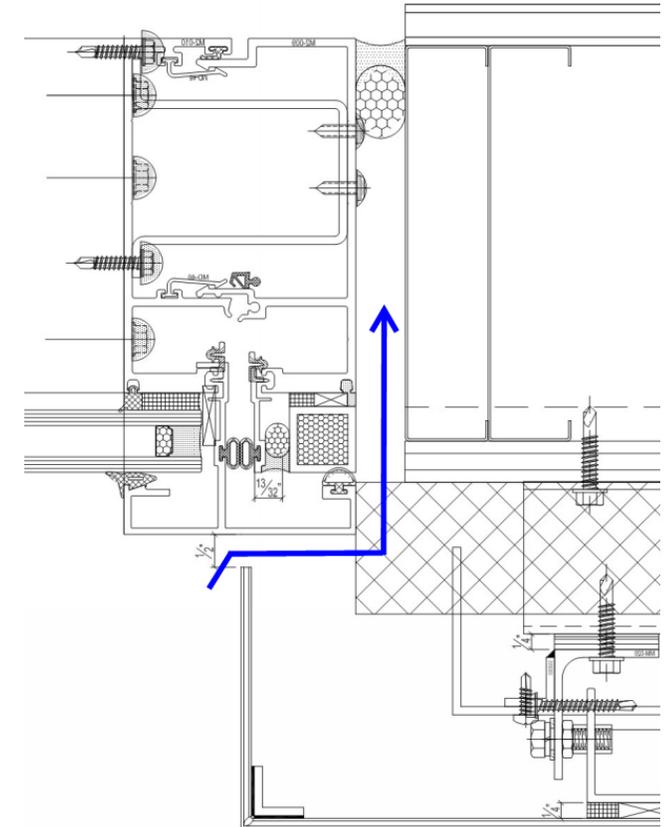
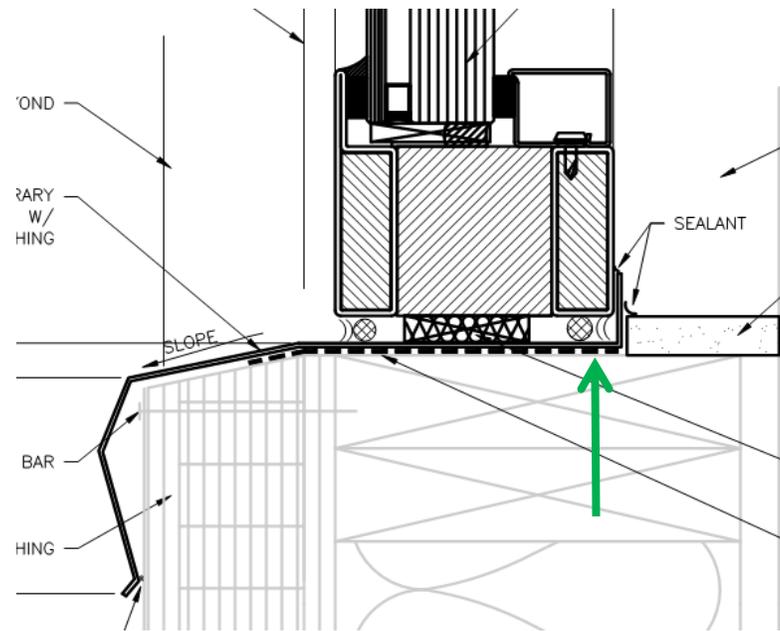
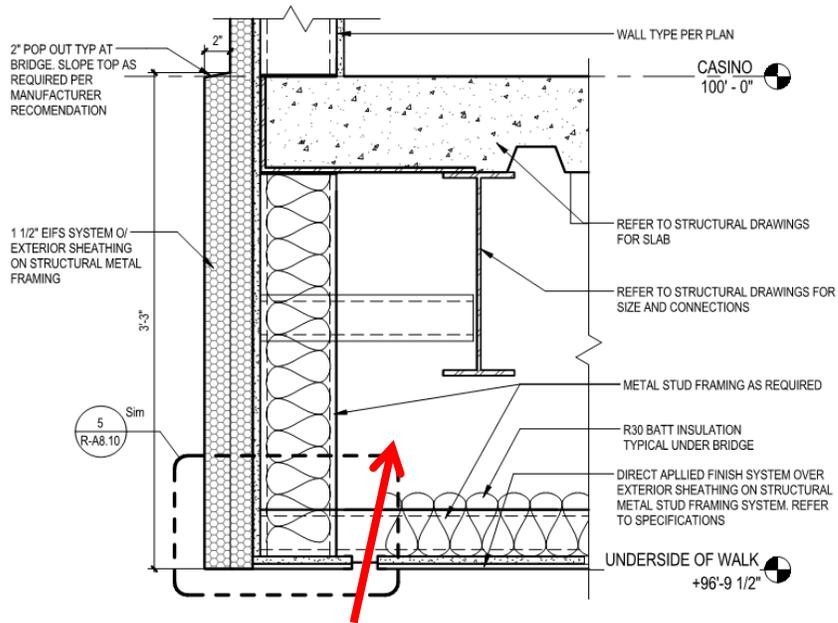
NEW CONSTRUCTION

- **Design Assistance**
 - Consultant to AOR
- **Delegated Design**
 - Consultant to AOR
- **Commissioning**
 - Consultant to Owner
- **Quality Assurance**
 - Consultant to O, A, or C



DESIGN PHASE CONSULTING

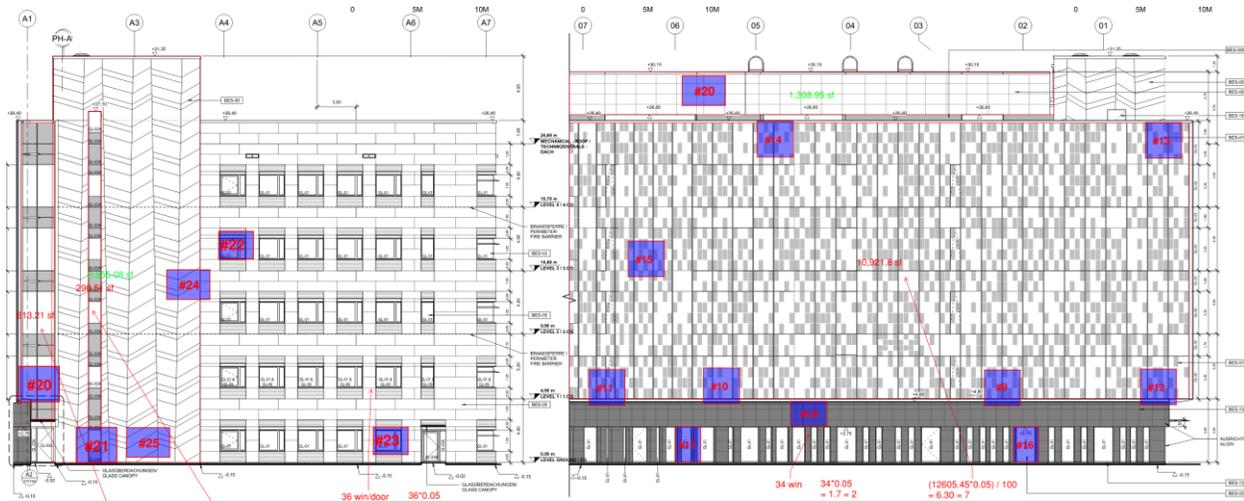
- THIRD PARTY CONSTRUCTABILITY & PERFORMANCE REVIEW
 1. Architectural Drawings and Specifications
 2. Submittal and Shop Drawing Reviews



DESIGN PHASE CONSULTING

• TEST PLAN DEVELOPMENT

1. Test Methods
2. Quantities
3. Specifications



Formed Metal Wall Panels (Specification 074213.13)	Not defined	CM		AAMA 501.2 nozzle testing	
Metal Plate Wall Panels – AB (Specification 074213.13)	Not defined	CM		AAMA 501.2 nozzle testing	
TPO Roofing (Specification 075423)	All roof areas	Owner		<ol style="list-style-type: none"> 1. (CM) ASTM F2170 Concrete roof deck substrate relative humidity: <u>One (1) probe per 1000 sq. ft.</u> 2. ASTM C1153 Infrared Thermography 	
Joint Sealants (Specification 079200)	10 tests for the first 1000 linear feet for each kind of sealant and joint substrate. 1 test per 1000 linear feet thereafter.	CM			ASTM C1521 (Method A)
Aluminum Framed Storefronts, adjacent air/moisture barrier (Specification 084113)	<ul style="list-style-type: none"> • Minimum of three (3) tests prior to 10, 35, and 70 % installation completion for AAMA 501.2 • Minimum of one (1) test prior to 35% completion for ASTM E1105 	CM		<ol style="list-style-type: none"> 1. AAMA 501.2 nozzle testing 2. ASTM E1105 static pressurization to include approximately 1 ft of surrounding construction (air/moisture barrier) 	
Window and Curtain wall, adjacent air/moisture barrier (Specification 084413)	<ul style="list-style-type: none"> • Minimum of three (3) tests prior to 10, 35, and 70 % installation completion for AAMA 501.2 • Minimum of three (3) test prior to 35% completion for ASTM E1105 	CM		<ol style="list-style-type: none"> 1. AAMA 501.2 nozzle testing 2. ASTM E1105 static pressurization to include approximately 1 ft of surrounding construction (air/moisture barrier) 	ASTM C1401 (Method A) structural-sealant adhesion test

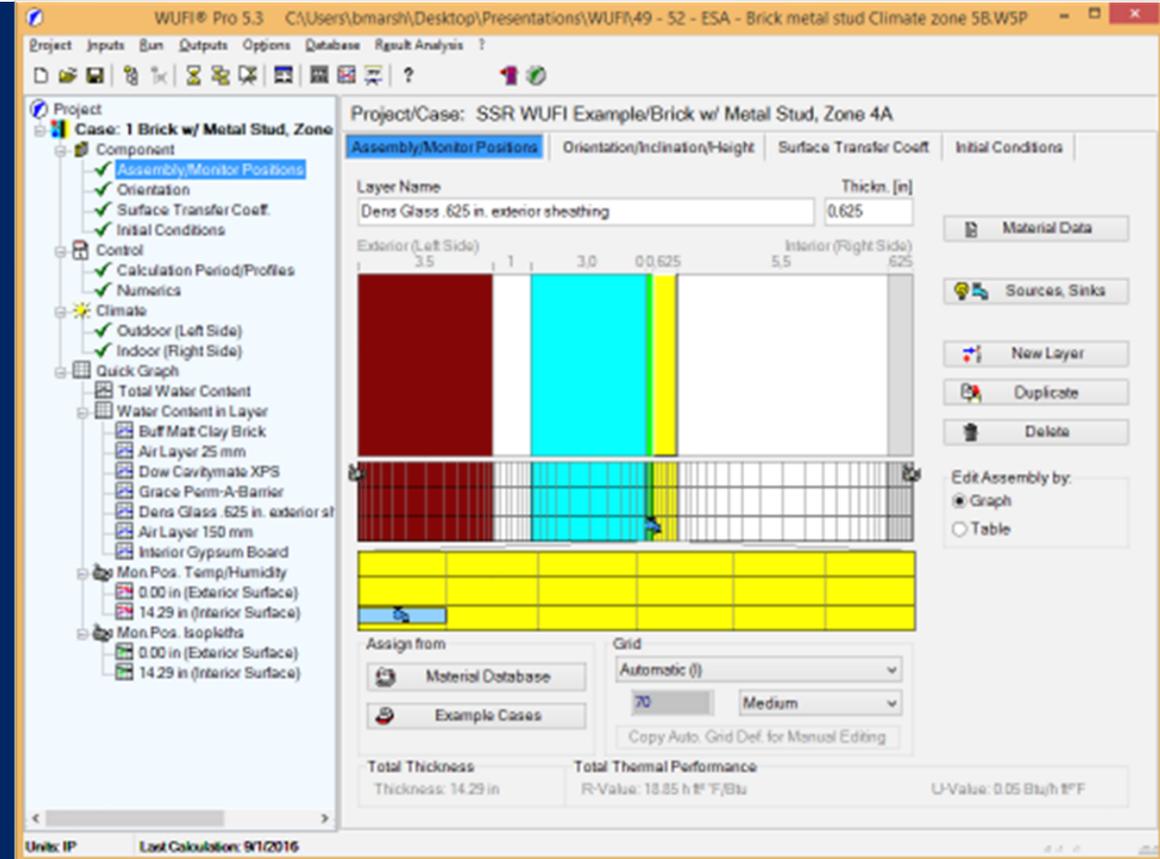
DESIGN ASSIST CONSULTING

Simulations

- WUFI – Vapor Drive
- THERM – Heat Transfer

Deliverable:

- Detailed report
- Graphical data - WUFI
- Illustration - THERM



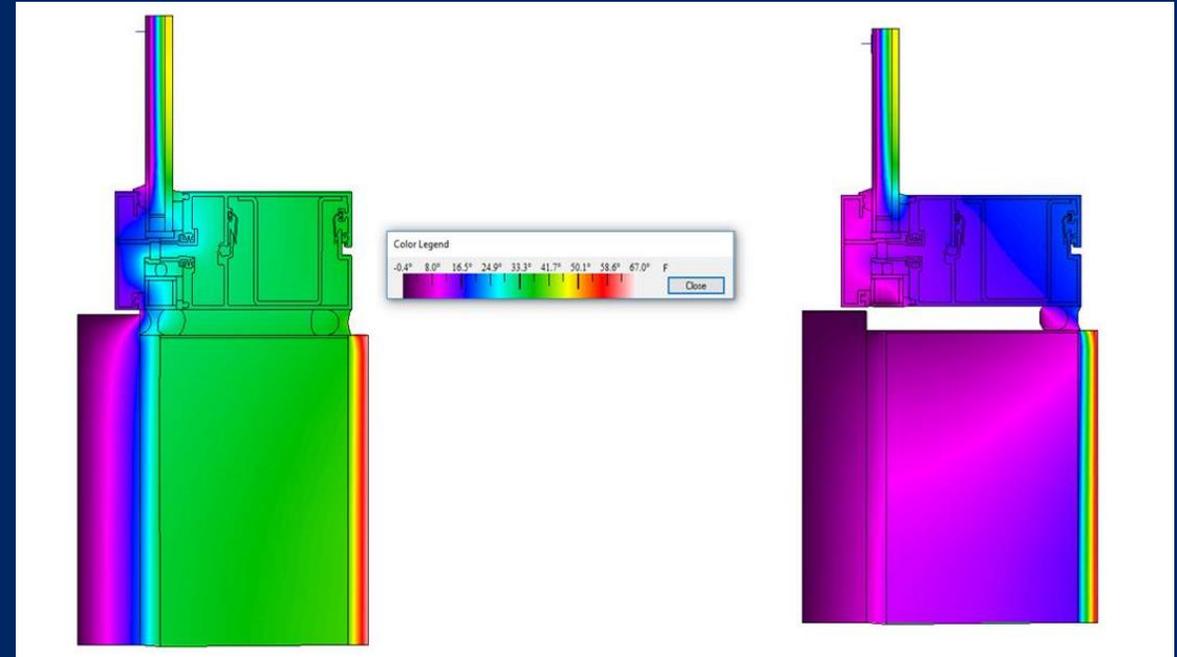
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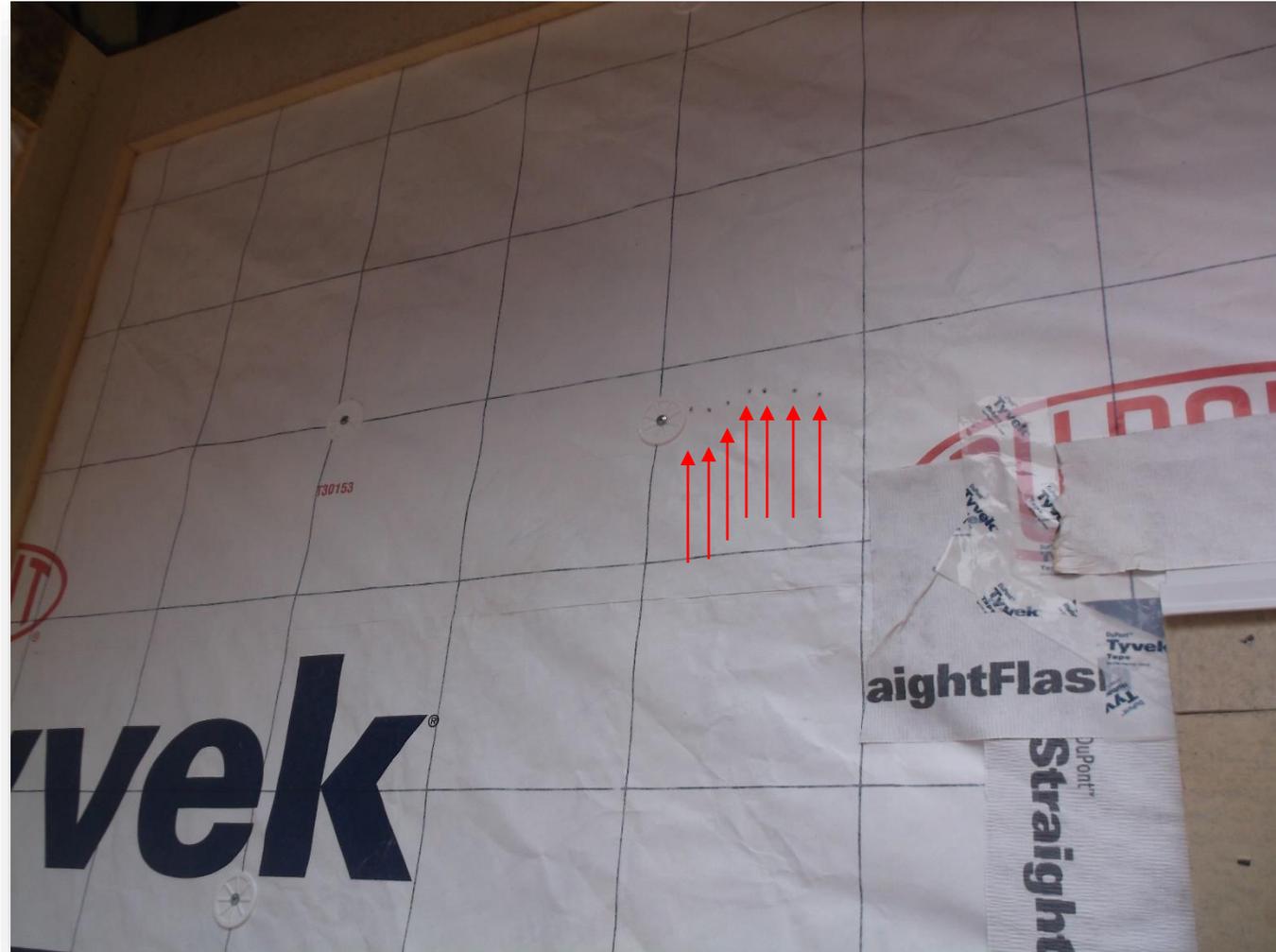
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CONSTRUCTION PHASE OBSERVATIONS



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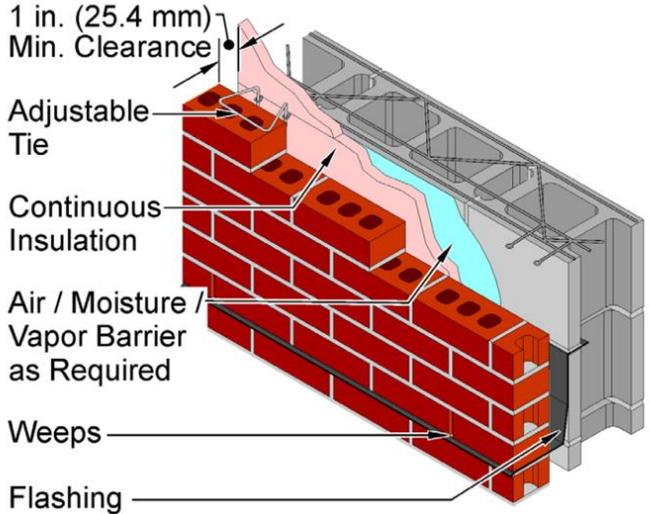


Figure 1
Typical Brick Veneer/CMU Wall



CONSTRUCTION PHASE TESTING

- Water Leakage



CONSTRUCTION PHASE TESTING



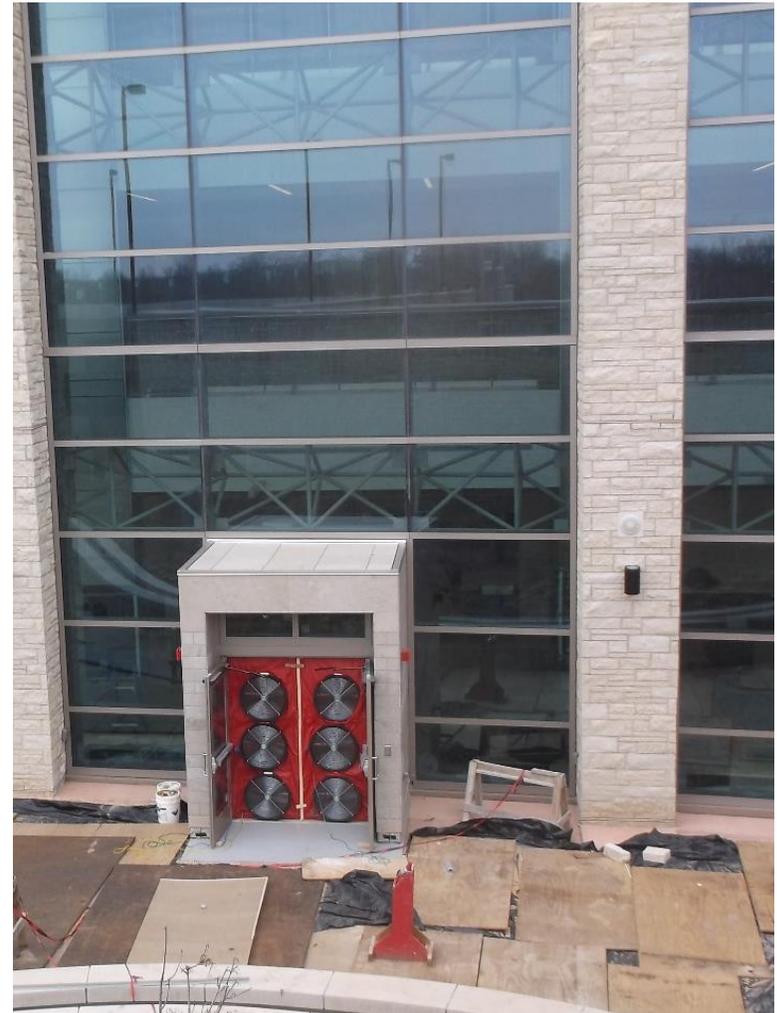
ASTM E1186—
Localized Air Leakage Testing
“Bubble Gun”



CONSTRUCTION PHASE TESTING

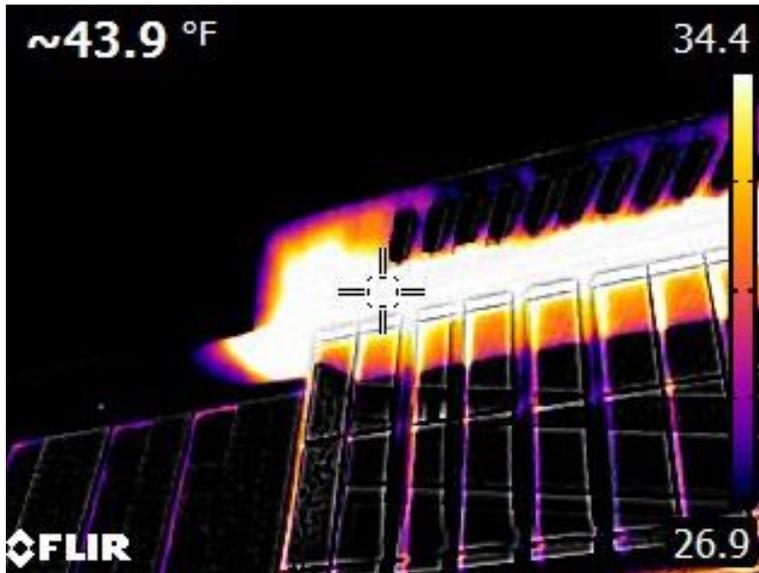


ASTM E779, USACE Protocol—
Whole Building Air Leakage
Testing



CONSTRUCTION PHASE TESTING

- Infrared
- Electronic Leak Detection



**RISK MITIGATION:
RENOVATIONS AND REPAIRS**

BUILDING ENCLOSURE CONSULTING

EXISTING BUILDINGS

- Condition Assessments
- Forensic / Failure Investigations
- Quality Assurance (Q&A)
- Repair Design & Construction Services



ROOF CONDITION ASSESSMENTS

Assessment of:

- All Roof Systems
- Flashings, Terminations
- Exterior Parapet Conditions

Deliverable:

- Detailed Reporting
- Remaining Service Life
- Recommended Corrective Action
- Budget Forecasting



EXTERIOR CONDITION ASSESSMENTS

Assessment of:

- Exterior Cladding
- Windows and Doors
- Existing Sealants
- Base of Wall Conditions
- Other Exterior Items

Deliverable:

- Detailed Reporting
- Remaining Service Life
- Recommended Corrective Action
- Budget Forecasting



BUILDING ENCLOSURE

- Air control



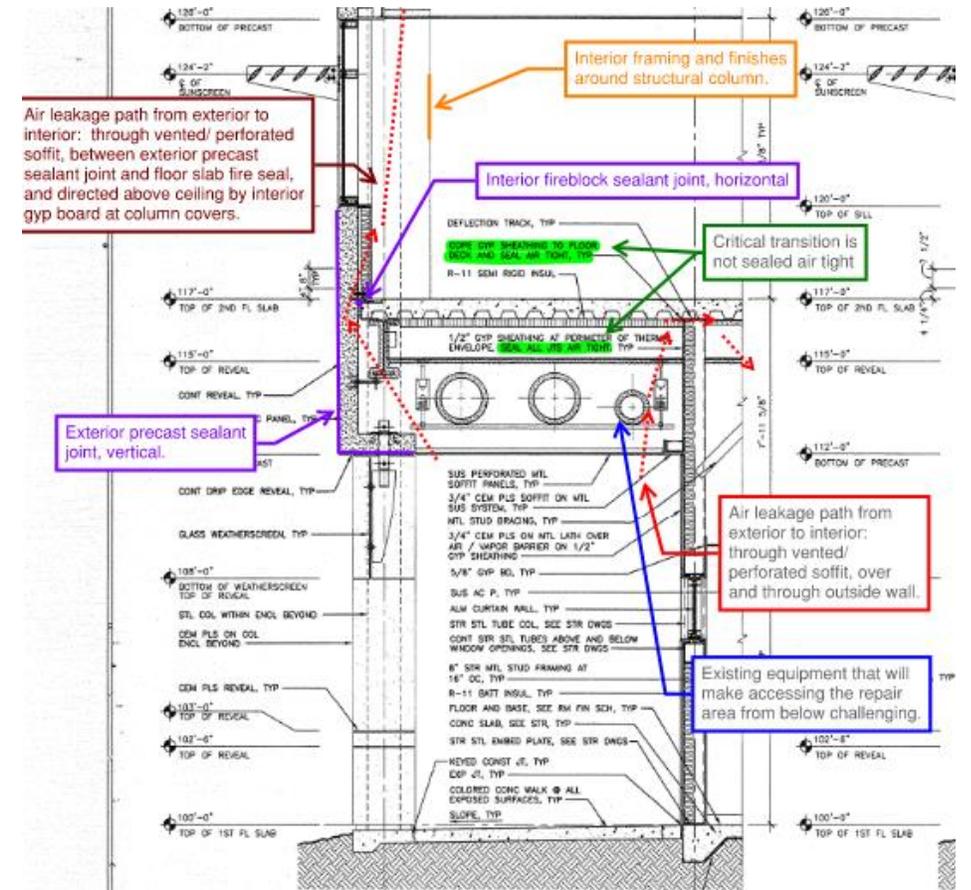
BUILDING ENCLOSURE

- Air control



BUILDING ENCLOSURE

- Air control



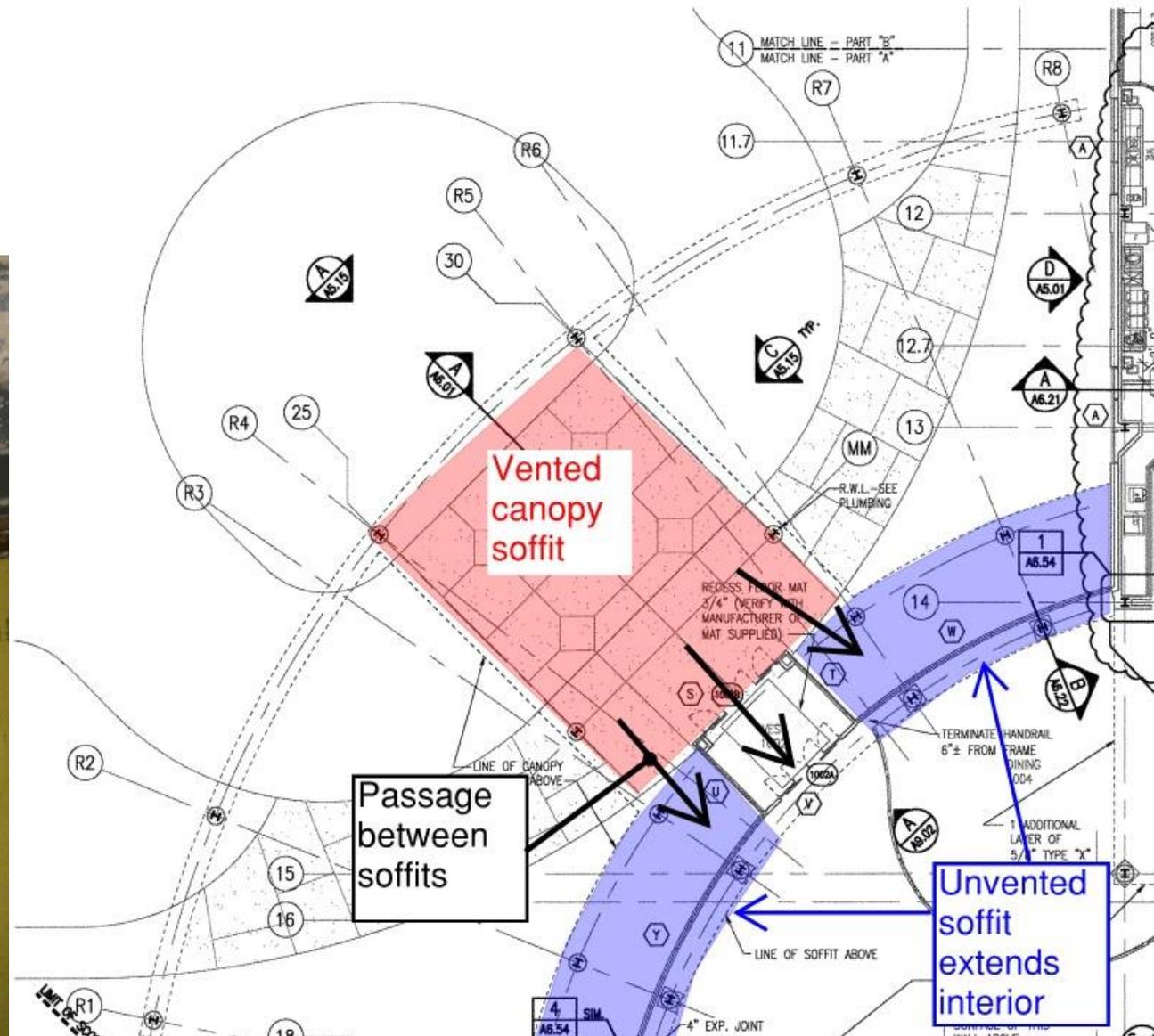
EXAMPLE INVESTIGATION

- Condensation



EXAMPLE INVESTIGATION

- Condensation



Know what to look for!

EXTERIOR CONDITION ASSESSMENTS

- Unmanned Aerial Vehicles (UAV)



DESIGN & CONSTRUCTION SERVICES

Design Document Creation

- Details and Construction Drawings
- Plans and Specifications
- Drainage Design
- Wind Uplift Design

Construction Services:

- Bid Solicitation
- Project Management
- Construction Administration



DESIGN & CONSTRUCTION SERVICES

1. Experience that aligns with client and project type.
2. Request qualifications packages.
3. Contact references.
4. Enclosure system specific experience.
5. Professional society involvement.

Q & A

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